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ABSTRACT

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RESEARCH BULLETIN

ORIGINS OF THE FIELD-DEPENDENT AND FIELD-INDEPENDENT COGNITIVE STYLES

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The literature on sources of individual differences in field dependence-independence is reviewed and findings on ontogenetic development and cross-cultural differences are incorporated into the theory of psychological differentiation. During the growth years, individuals develop toward greater field independence. Hormonal and X-linked genetic factors may influence development of specific cognitive components of the field-dependence-independence dimension. It is clear from a wide variety of data that the development of field independence is enhanced by appropriate training programs, child-rearing practices which encourage separation from parental authority, and "loose" social structures which permit individual autonomy. Among subsistence-level societies, members of nomadic hunting groups tend to be more field independent than members of sedentary farming groups. Viewed from an ecocultural perspective, this finding suggests a progression from relative field independence toward relative field dependence as cultural forms changed from early hunting to later agricultural economies. That developmental changes may proceed in opposite directions in the course of ontogeny and during cultural history is compatible with the bipolar conception of cognitive styles; the cognitive restructuring skills of field-independent individuals and the social-interpersonal competencies of field-dependent individuals have adaptive value in different life circumstances.

ORIGINS OF THE FIELD-DEPENDENT AND FIELD-INDEPENDENT COGNITIVE STYLES

During recent years there has been a rapid growth of research on the nature of the field-dependence-independence cognitive-style dimension and the origins of individual differences in that dimension.[1] A revised conception of the nature of the dimension, incorporating the new findings, has been proposed elsewhere (Witkin & Goodenough, Note 4). In this paper we review the evidence bearing on the origins of differences in cognitive style with the aim of identifying the sources of individual differences during both ontogenetic development and the historical development of cultural forms. To provide the necessary theoretical background for examining the origins issue, we first outline our current conception of field dependence-independence.

THE FIELD-DEPENDENCE-INDEPENDENCE DIMENSION

Field-dependence theory, which is still evolving, seeks to account for the ever-broadening, self-consistent patterns of psychological functioning originally identified in the course of research on the nature and basis of individual differences in perception of the upright (Witkin, Dyk, Faterson, Goodenough, & Karp, 1962/1974; Witkin, Lewis, Hertzman, Machover, Meissner, & Wapner, 1954/1972). Field dependence-independence has its conceptual home in the broader theory of psychological differentiation. In briefest terms, differentiation refers to the complexity of structure of a psychological system and the nature of its relation to its surround. Greater differentiation implies the formation of articulated subsystems within the organism, capable of carrying out specific functions in

specialized fashion. It is manifested in greater segregation of psychological and neurophysiological functions and greater segregation of the self from its immediate environment. Because the development of differentiation is an organism-wide process, we have hypothesized that the tendency to function in a more differentiated or less differentiated way is likely to characterize a person's activities across psychological domains, and the neurophysiological domain as well, contributing to self-consistency in individual functioning. Since research on the origins of individual differences in differentiation has been concerned almost entirely with the self-nonself-segregation component, we limit ourselves here to an account of this aspect of differentiation theory alone.

Self-nonself segregation is a product of increasing awareness, during growth, of a distinction between inner and outer, leading to the formation of boundaries between self and the world outside, particularly other people. With increasing self-nonself segregation internal referents become available as guides to behavior. A more limited repertoire of internal referents, associated with less self-nonself segregation, encourages reliance on external referents. The tendency to rely primarily on internal referents in information processing has been called a field-independent cognitive style. The tendency to place greater reliance on external referents is a field-dependent cognitive style.

These contrasting tendencies are reflected in performance in two of the tests that have been used to assess them. In one, the rod-and-frame test (RFT), subjects view a luminous rod centered within a tilted luminous frame, and are required to align the rod with the gravitational upright. They may use the

axes of the external visual field or their own bodies as bases for judgment. In the other, the body-adjustment test (BAT), subjects are seated in a tilted room and asked to align themselves with the upright. The information sources available to them in the BAT are the same as in the RFT, and people are likely to be consistent in performance across these and other similar situations in degree of reliance on self or field.

The extent to which people favor internal and external referents may be observed in their social behavior as well. The evidence clearly shows that field-dependent people function less autonomously of others in interpersonal relations, in a manner analogous to their greater reliance on the visual field in perception of the upright. Thus, field-dependent people are more likely to use external social frames of reference in defining their attitudes under ambiguous conditions (e.g., Birmingham, 1974; Linton, 1955). The evidence thus suggests that the field-dependence-independence construct may be defined as a general dimension of individual functioning involving degree of autonomy from vs. reliance on external referents.

The extent to which people rely on internal or external referents also has implications for cognitive and interpersonal competencies.

In perceptual and intellectual activities field-independent people are able to restructure the field with which they must deal when the task at hand requires it. Field-dependent people, having less recourse to internal referents, are likely to adhere to dominant properties of the field as presented. Restructuring is in effect the expression of field independence in cognitive functioning.

A number of dimensions conceived to involve cognitive restructuring have now been related to performance in tests of perception of the upright (Witkin

& Goodenough, Note 4). The tendency to rely on the body as a referent in these tests was early related to facility in breaking up an organized complex design in order to locate a simple figure hidden within it in the embedded-figures test (EFT) (Witkin, Lewis, Hertzman, Machover, Meissner, & Wapner, 1954/1972). This evidence led to use of the EFT as a convenient test of field dependence-independence. Subsequent studies have made it entirely clear that field independence is closely related to a cognitive factor, commonly defined by EFT types of tests (e.g., Goodenough & Karp, 1961; McWhinnie, 1970a), which Thurstone (1944) designated "flexibility of closure" and which in the literature on field dependence-independence has been known as "disembedding." Another commonly used test which appears to tap this same dimension is Block Design. Successful performance in tasks such as EFT and Block Design obviously requires restructuring of the perceptual field.

Field independence has also been related to performance in a variety of other perceptual and problem-solving tasks calling for skill in cognitive restructuring. To illustrate, field-independent people are better able than field-dependent people to impose organization on an impoverished stimulus array in tests of closure speed (e.g., Goodman, cited in Witkin et al., 1962/1974; Yamada, 1968); to show conservation in Piagetian tasks (Dolecki, 1976; Pascual-Leone, 1969); to judge objects according to their retinal representation in constancy situations (e.g., Gardner, Holzman, Klein, Linton, & Spence, 1959; Perez, 1955); to do better in tasks which require decentering, such as the Piagetian three-mountain problem (e.g., Assawamatiyanont, 1971; Okonji & Olagbaiye, Note 5); and to do better on standard paper-and-pencil tests of spatial-visualization (e.g., Gardner, Jackson, & Messick, 1960; Hyde, Geiringer, & Yen, 1975; Vernon, 1972). The expectation that field-independent people are

more likely to use a restructuring approach in a variety of cognitive tasks which feature that competence is now well supported.

Turning to social behavior, the greater connectedness between self and others of field-dependent people and the greater self-other polarity of field-independent people, is reflected in differences between them in social sensitivity and interest in people. For example, field-dependent people are more attentive to social cues (e.g., Eagle, Goldberger, & Breitman, 1969; Fitzgibbons & Goldberger, 1971; Ruble & Nakamura, 1972); they more readily tell others about themselves, reflecting greater emotional openness (e.g., Greene, 1973; Sousa-Poza, Rohrberg, & Shulman, 1973); and they prefer to be with people (e.g., Bard, 1972; Coates, Lord, & Jakobovics 1975), even physically close to them (e.g., Holley, 1972; Justice, 1969). It seems reasonable to hypothesize that the interpersonal orientation of field-dependent people, and their more extended experience with others, may foster the development of effectiveness in social-interpersonal behavior. In support of this hypothesis, there are some findings which suggest that field-dependent people may get along better with others (e.g., Oltman, Goodenough, Witkin, Freedman, & Friedman, 1975), may be more popular with their peers (Oltman et al., 1975; Wong, 1976), and more successful in occupations which emphasize interpersonal relations (MacKinnon, 1962; Quinlan & Blatt, 1972). The evidence that field-dependent people have more of the social behaviors and attributes helpful to effective interpersonal relations, and the possibility that they may be better at getting along with others, suggests a picture of more developed interpersonal competencies among them than among field-independent people.[2]

Two features of field-dependence theory are particularly important for the question of the origins of differences in cognitive style. One is the hierarchical arrangement of its constructs, the other the adaptive qualities of the contrasting cognitive styles.

In the theory that has been outlined, the cognitive and social variables are arranged in the pyramidal structure typical of factor-analytic models, with the most general component (differentiation) at the apex, and the most specific components (test scores) at the base. The narrowest constructs (e.g., disembedding, spatial-visualization) are conceived as first-order factors, located just above the base; the next most general constructs are conceived as second-order factors (restructuring and interpersonal competencies); and the still more general construct (field dependence-independence) as a third-order factor, located just below the apex.

This structure seems reasonable theoretically, and there is evidence from factor analytical research to support some parts of it (Witkin & Goodenough, Note 4). Because disembedding, spatial-visualization, and many other perceptual and intellectual abilities assumed to involve restructuring can be measured effectively by paper-and-pencil tests, thereby making large scale factor-analytic studies economical, the definition of the restructuring factors in which field dependence-independence expresses itself is relatively clear. We assume that tests of perception of the upright, which assess the use of internal or external referents, provide direct measures of field dependence-independence, but the precise location of the RFT and BAT within the factor domain has not yet been definitely established. Much less research has been done on the expression of field dependence-independence in the social-interpersonal domain.

One reason for this is historical: the social aspects of field-dependence theory have been developed relatively recently. Another reason is practical: it is difficult to devise effective tests of the wide range of social behaviors implicated in the theory. Though there is consequently a much larger literature to be reviewed on the origins of the cognitive than of the social aspects of the field-dependence-independence dimension, this imbalance does not at all reflect the importance assigned to these two aspects in our current theory.

In the evidence on the origins issue to be reviewed, there is the recurrent question of which dimension, or dimensions, in the hierarchy are affected by the independent variables examined. The pyramidal structure of our model implies that when developmental changes are brought about in one dimension, there are likely to be effects on other dimensions nested below it in the hierarchy. A change in a higher-order dimension should therefore have lower-order consequences with predictable effects on a variety of test scores. Patterns of test-score changes, brought about by manipulation of a particular independent variable, may therefore be useful in drawing inferences about which dimension in the hierarchical structure is affected.

"Field dependence-independence" is our name for the construct, reliance on external vs. internal referents. In the literature to be reviewed, measures of that construct have sometimes been obtained from the RFT or BAT, but occasionally from some combination of restructuring tests, including the EFT. To avoid excessive detail, the specific tests used will be noted only when the pattern of test scores appears to be informative in some way.

Turning now to the second feature of field-dependence theory important for the origins issue--the adaptive character of cognitive styles--we have suggested

that greater self-nonself segregation fosters the use of internal referents (a field-independent cognitive style), and thereby stimulates the development of cognitive restructuring skills. In contrast, limited self-nonself segregation encourages reliance on external referents (a field-dependent cognitive style), thereby contributing to the development of social competencies.

Field-dependent and field-independent people thus seem to make their main developmental investments in different psychological domains. To the extent that field-dependent and field-independent people both have clearly identifiable though different competencies, the field-dependence-independence dimension is bipolar; that is, it has no clear high or low end. As a consequence the dimension is value-neutral, in the sense that adaptive qualities are to be found at both poles. Their bipolarity and value-neutral stance make it particularly appropriate to conceive of field dependence and field independence as cognitive styles.[3]

In view of the different adaptive consequences of field-dependent and field-independent modes of functioning, it seems reasonable to expect that these cognitive styles would be broadly tuned to the adaptive requirements of life circumstances both ontogenetically and cross-culturally. In the sections that follow we consider, first, the course of ontogenetic development, and how this tuning may be accomplished during the life history of the individual. We then consider the historical course of human cultural development in relation to the adaptive aspects of the field-dependent and field-independent cognitive styles.

DEVELOPMENT OF FIELD DEPENDENCE-INDEPENDENCE DURING ONTOGENY

The characteristic sequence in individual development is clearly from a field-dependent to a field-independent mode of functioning. In perception of the upright, for example, both cross-sectional and longitudinal studies have shown a progressive decrease in the effect of the visual field, and increasing reliance on the body as a referent, until about the midteen years, with little further change during the years of maturity (e.g., Witkin et al., 1962/1974; Witkin, Goodenough, & Karp, 1967; Witkin et al., 1954/1972). Evidence available on cognitive restructuring skills shows a similar developmental trend (e.g., Maccoby & Jacklin, 1974; Witkin et al., 1962/1974). Moreover, it is obvious that children function less autonomously of others in interpersonal relations than do adults.

Going beyond these group trends, it is clear that individual differences exist in development toward greater field independence, and are to be found at every age beginning as early as the preschool period (Coates, 1975; Coates et al., 1975). Children who develop rapidly toward field independence develop greater competence in cognitive restructuring. Because of their greater autonomy, we assume that they are not as likely to have the extensive experience in interpersonal relations which foster the development of interpersonal competencies among field-dependent children.

The evidence also suggests some differences in development of field dependence-independence among boys and girls in Western cultures. It is well known that among adults, males tend to be more field independent than females on the RFT (e.g., Witkin et al., 1962/1974). Sex differences have

not been found as consistently on the BAT, but few studies have been done with this test because of the elaborate equipment it requires. Adult males do tend to score higher than females on many tests of restructuring skills, however (e.g., Maccoby & Jacklin, 1974; Witkin et al., 1962/1974). Social-interpersonal skills may also be higher among women than men (e.g., Tyler, 1965), but this conclusion is not accepted by all authorities (e.g., Maccoby & Jacklin, 1974).

Considering trends in development of restructuring skills, the evidence suggests that pronounced sex differences in spatial-visualization ability (one of the specific restructuring abilities) emerge only during adolescence, with boys' superiority increasing through the high school years (e.g., Maccoby & Jacklin, 1974).

The course of development of sex difference in disembedding ability may be similar to that of spatial-visualization ability (Maccoby & Jacklin, 1974), but the data on this issue are more difficult to interpret because the rapid development of disembedding skill during the growth years has led to the use of different tests at different ages. Thus, the Preschool EFT (Coates, 1972), has been used almost exclusively for children below the age of six, and there is some indication of sex differences in favor of young girls on this test (e.g., Coates, 1974).

The Children's EFT (Karp & Konstadt, 1971) has most often been used for preadolescent school children. Although most studies have found that males tend to score higher than females on this test in this age period (e.g., Clack, 1970; Eddy, 1974; Finley & Solla, 1975; Stanes & Gordon, 1973), the differences are very small and usually not significant. A great variety of embedded-figures types of tests has been used with adolescents and adults, with marked

differences in results among tests. On the individually administered EFT, mean scores typically tend to be higher for men than for women (e.g., Witkin et al., 1962/1974), but sex differences are very small for group forms of the test, and usually significant only for very large samples (e.g., Dickie, 1969; Doherty, 1968; Nedd & Gruenfeld, 1976; Renzi, 1974). In view of the variation in results among tests with adults, and the use of different tests for different age groups, it is difficult to draw any definite conclusions about trends in the development of sex differences in disembedding ability.

For the RFT the developmental picture is quite clear. With few exceptions, studies of preadolescent school children have shown that boys tend to be more field independent on this test than girls (e.g., Dreyer, Dreyer, & Nebelkopf, 1971; Pearlstein, 1971). Furthermore, in our own cross-sectional and longitudinal studies, designed to span the age range from preadolescence (8 years) to young adulthood (17 years), no significant Age x Sex interaction was found on the RFT (Witkin et al., 1967).[4] These data indicate that on the RFT prominent sex differences emerge developmentally before puberty, in contrast to spatial-visualization and (possibly) disembedding abilities, and suggest a different origin of sex differences in perception of the upright than in cognitive restructuring.

In searching for the sources of these developmental changes, individual differences, and sex differences we first examine the role of biological factors and then the role of training and of life experiences in the contexts of socialization, cultural encounters and ecology.

BIOLOGICAL FACTORS IN ONTOGENETIC DEVELOPMENT

The finding that males tend to be more field independent than females has drawn attention to the possible roles of hormonal and sex-linked genetic factors in the development of field-independent and field-dependent cognitive styles.

Hormonal Determinants of Field Dependence-Independence

A number of investigators have suggested that field dependence-independence, interpersonal autonomy, restructuring ability, and/or spatial-visualization ability may be influenced by sex hormone levels (e.g., Bock & Kolakowski, 1973; Broverman, Klaiber, Kobayashi, & Vogel, 1968; Dawson, 1972; Petersen, 1976; Smith, 1971; Waber, in press). Some of these investigators have focused on the role of androgen/estrogen ratios during development. For example, Dawson (1972) has suggested that relatively high androgen/estrogen ratios during a critical period in the early life history of an individual may favor the development of a field-independent cognitive style. Other investigators have focused on the age of onset of puberty, an event that is influenced by prepubertal hormonal levels, and that in turn influences hormonal levels. For example, Waber (1976; 1977) has raised the possibility that development toward greater spatial-visualization ability may be inhibited at pubertal onset. Still other investigators have been concerned with androgen or estrogen levels at the time of testing. For example, Broverman et al. (1968) have suggested that high levels of either may impair restructuring abilities at any age. The biochemical theory advanced by Broverman et al. that sex hormone levels may have an immediate (as opposed to developmental) effect on restructuring ability has

been severely criticized (e.g., Parlee, 1972; Singer & Montgomery, 1969). Broverman's hypothesis has stimulated a variety of research with normal people on the role of hormonal factors in restructuring ability, however.

There is now a considerable body of evidence for adult males that measures of masculinity in body build and secondary sex characteristics are inversely related to measures of restructuring ability (e.g., Broverman, Broverman, Vogel, Palmer, & Klaiber, 1964; Broverman & Klaiber, 1969; Klaiber, Broverman, & Kobayashi, 1967; Murawski & Jones, 1970; Petersen, 1976; Rosenberg, 1975). For females, the evidence on relationships between physical signs of femininity and restructuring ability is not as clear, but studies with women are still sparse (Petersen, 1976; Rosenberg, 1975).

Physical measures of masculinity in male adults and femininity in female adults may reflect an earlier onset of puberty (Waber, 1977). Moreover, there is some evidence, although it is not entirely consistent, that within each sex, individuals who reach puberty relatively late tend to score higher on the EFT, Block Design, and spatial-visualization tests than do early maturers (Broverman et al., 1964; Petersen, 1976; Waber, 1976). Evidence recently reviewed by Waber (in press) also indicates that early maturers have a more interpersonal orientation and are more reliant on other people as adults. As Waber points out, these findings suggest that biological factors play some role in the development of spatial-visualization restructuring ability, and/or field dependence-independence, perhaps mediated by hormonal effects on hemispheric differentiation of cortical functions.

The within-sex differences in pubertal age have also suggested the hypothesis that the male superiority in restructuring ability may be due

to the later age of maturation in boys than girls (Waber, 1976, 1977, in press). The fact that boys' superiority over girls' in spatial-visualization ability (and perhaps disembedding ability) becomes prominent only during adolescence also fits well with the idea that these abilities may show an arrest in development with pubertal onset. In this view, late maturers, who are more likely to be boys, may have a longer prepubertal period during which cognitive restructuring skills continue their rapid development.

While it seems possible in the case of restructuring ability that individual differences in general, and sex differences in particular, may be affected by hormonal events during adolescence, this type of explanation may not apply to the field-dependence-independence dimension. As noted in the preceding section, prominent sex differences in RFT performance emerge before puberty, in contrast with the developmental trend in spatial-visualization ability. Moreover, the cognitive and personality correlates of RFT performance have been found in preadolescent children as well as in adults. These findings suggest that the origins of the field-dependent and field-independent cognitive styles lie in earlier developmental events.

Evidence for the hypothesis that early hormone levels may influence subsequent development has come from experimental research with animals on the effects of hormonal injections upon the use of spatial information in maze behavior (e.g., Dawson, 1972) and from studies of human pathological groups with a developmental history of hormone abnormalities (e.g., Dawson, 1966; McGuire, Ryan, & Omenn, 1975; Money, 1968; Yalom, Green, & Fisk, 1973). Among these groups, the clearest results have been found in females with Turner's syndrome and in kwashiorkor males. Most studies have shown that Turner women, who are deficient

in sex hormones during development, are relatively field dependent on the EFT and, though of normal verbal intelligence, are dramatically impaired on tests of spatial visualization and disembedding (e.g., Money & Alexander, 1966; Shaffer, 1962; Nyborg, Note 6; Serra, Pizzamiglio, Boari, & Spera, Note 7). Kwashiorkor cases, who have low androgen/estrogen ratios during development, also show specific impairment on restructuring tasks, such as spatial-visualization tests (e.g., Dawson, 1966).

While it seems plausible to suppose that hormonal factors may play some roll in the cognitive functioning of these groups, the fact that Turner and Kwashiorkor cases are abnormal in many ways makes it difficult to rule out other possible biological and social explanations of the observed impairment. It is important, therefore, to ask whether groups with abnormally high levels of sex hormones or androgen/estrogen ratios in their early developmental history are superior in restructuring abilities. One study examined EFT and Block Design performance in patients afflicted with congenital adrenal hyperplasia, an abnormality involving high fetal androgen/estrogen ratios (McGuire et al., 1975), but the number of cases was small and the results inconclusive.

A number of models have now been proposed to account for the relationships with hormonal levels at various ages during the growth years. The most clearly worked through of these models assumes that hormonal levels influence the development of hemispheric specialization of function, which in turn affects cognitive restructuring skills and/or field dependence-independence (e.g., Dawson, 1972; Waber, in press). These models appear to be consistent with differentiation theory. Much more research is needed, however, to clarify the basis of this relation and to determine whether hormonal levels are also related to other expressions of field dependence-independence.

Genetic Factors in Field Dependence-Independence

In has been proposed that spatial-visualization and disembedding abilities are influenced by an X-linked recessive gene (e.g., Bock & Kolakowski, 1973; Stafford, 1961; O'Connor, Note 8); and several implications of the X-linked model have been tested to examine this possibility.

One kind of evidence has been sought in patterns of correlations between parents and children. Since fathers contribute their only X-chromosome to their daughters, and sons receive their only X-chromosome from their mothers, X-linked inheritance should produce relatively high correlations between members of opposite-sex parent-child pairs, and no correlation between fathers and sons. This pattern has been found for tests of spatial-visualization ability in some studies (Bock & Kolakowski, 1973; Hartlage, 1970; Stafford, 1961), but not in others (DeFries, Ashton, Johnson, Kuse, McClearn, Mi, Rashad, Vandenberg, & Wilson, 1976; Spuhler, 1976). In the case of the EFT, one early study found some marginal indication of higher relationships between members of opposite sex than between members of same-sex parent-child pairs, as would be expected from an X-linked genetic model (Corah, 1965). This finding has not been supported by subsequent studies, however (Grunebaum, Weiss, Gallant, & Cohler, 1974; Oliver, 1974; Schaffer, 1969; Sholtz, 1973).

While the findings from these studies are inconsistent, they do not warrant rejection of the X-linkage hypothesis. Preadolescent children were used in some of the studies cited, and it is an open question whether X-linked genetic effects on these tests are to be expected before puberty. Moreover, it is possible that sex-role modeling effects on the development of field

dependence-independence (which we discuss in a later section) foster father-son and mother-daughter relationships that are different from and therefore obscure the pattern expected on a genetic basis. It may therefore not be possible to test the X-linkage hypothesis decisively with data on parent-child correlations.

Some of the other implications of an X-linkage model can be tested without such difficulties. One clearer implication concerns the pattern of relationships between sibs. Since all sisters share the only X-chromosome their father has to contribute, but brothers may receive a different one of the two X-chromosomes their mother has to contribute, X-linked inheritance should produce higher correlations between sisters than between brothers. Some evidence of such a pattern has been found for spatial-visualization ability (e.g., Petersen, 1973; Yen, 1973). In addition, several studies have shown that distributions of scores from several tests of spatial-visualization give evidence of bimodality, with frequency distributions that approximate a 50-50 division between the two groups of scores for men and a 25-75 split for women, as might be expected on the basis of an X-linked model (Bock & Kolakowski, 1973; Yen, 1975). Together these findings suggest that there may be a major gene locus on the X-chromosome, with recessive and dominant alleles, which contributes to individual differences in spatial-visualization ability.

Still other testable implications of the X-chromosome model lie in patterns of linkage to be expected among characteristics in transmission from parents to offspring. If two genes are located close together on the same chromosome, they tend to be transmitted together. Given a number of phenotypical characteristics that are known to be determined by genes spaced along the X-chromosome (marker variables), this fact can be used to assess an X-linkage hypothesis. The model

is relatively simple for transmission to sons, since sons receive only one X-chromosome from their mothers. For mothers who are heterozygous with respect to a particular X-marker variable (i.e., their two X-chromosomes bear different alleles at the gene locus), a pair of brothers who are similar to each other in the marker variable should also show greater similarity to each other in characteristics influenced by neighboring genes than a pair of brothers who differ from each other in the marker variable. Were sufficient marker variables available, the hypothesis that spatial-visualization, restructuring, or field dependence-independence have an X-linked determinant could be tested by analyses of similarities among brothers. Only a few practically useful X-chromosome markers are now known, however. As a consequence, a gene locus may be too distant on the X-chromosome from any useful marker for linkage to be detectable. While linkage studies of this sort are not very sensitive as yet, there is no problem of interpretation should evidence of linkage be found. In fact, the data from one linkage study suggest that performance on both the EFT and RFT may be influenced by an X-chromosome gene located close to the locus for the Xg blood groups (Goodenough, Gandini, Olkin, Pizzamiglio, Thayer, & Witkin, 1977). Because the number of informative families was relatively small in that study, and no a priori hypotheses about specific gene loci were possible, its results are more suggestive than definitive, however.

It is noteworthy that no evidence of linkage with the Xg marker for tests of spatial-visualization ability was found in the Goodenough et al. study. This suggests that if an X-chromosome gene contributes to EFT and RFT performance, it is not the same one that contributes to spatial-visualization ability. These observations are consistent with the evidence cited earlier that, at least

for the RFT, the trend in the development of sex differences may not be the same as for tests of spatial-visualization ability. It has been suggested that the sex differences observed in embedded-figures tests and in tests of perception of the upright may be due to the involvement in these tests of spatial-visualization ability (Maccoby & Jacklin, 1974; Sherman, 1971), and by implication of the same X-linked recessive gene. While the nature of the difference between men and women on the EFT and RFT is not yet clear, most of the evidence now available indicates that sex differences in the traditional measures of field dependence-independence have a different basis than sex differences in spatial-visualization ability.

In summary, it seems likely that some portion of the variance among people in spatial-visualization ability is attributable to an X-linked genetic determinant, perhaps mediated by hormonal factors. The evidence also suggests that this determinant may have a relatively specific effect on spatial-visualization, not extending to the level of field dependence-independence in our conceptual hierarchy.

With the very limited evidence on hand, a definitive statement about the possible origins of field dependence-independence in the biological development of the individual--hormonal and genetic--is clearly not yet possible, but the concepts and findings already on hand suggest promising directions for further research.

TRAINING, CHILD-REARING AND CULTURAL FACTORS IN ONTOGENETIC DEVELOPMENT

Whatever future research may reveal about biological contributions to field dependence-independence, it is entirely clear, from a large body of evidence

already available, that environmental variables play a very important role in the development of that dimension. A variety of environmental variables has now been studied, ranging from training programs designed to improve specific restructuring skills to child-rearing practices and cultural factors which may affect development of the broader characteristic of self-nonself segregation.

Training

There is a growing literature on the contribution of training to performance on tests of spatial visualization, disembedding and perception of the upright. The evidence from these studies suggests that the course of development in these dimensions may be affected by a variety of educational programs.[5]

The earliest studies of the influence of training on the EFT and RFT examined the effects of relatively brief periods of practice and/or instruction on the specific test performance the training was designed to improve (Gottschaldt, 1926; Witkin, Note 9), and this line of work has been continued in a number of more recent studies (Elliott & McMichael, 1963; Goldstein & Chance, 1965; Klapper, 1969; Weiner, 1955; Wilkie, 1973). It is evident from these studies that performance on the EFT may be improved by practice with the test materials. Performance on the RFT may also be changed in a field-independent direction by focusing attention on body cues, or by learning to compensate for the illusory effect of the tilted frame. While these various training procedures affect test performance itself, it is doubtful that they alter the underlying perceptual functions of concern to us (Witkin, Note 9). Extensive instructional efforts which result in transfer of training to other

test materials than those used in the training clearly have more important implications for both theory and educational applications. We turn now to studies of that kind.

One type of training study has been stimulated by reports that artists and musicians tend to be particularly field independent (e.g., Gaines, 1975; McFie, 1961; Trent, 1974; Witkin, Oltman, Chase, & Friedman, 1971; Witkin, Moore, Oltman, Goodenough, Friedman, Owen, & Raskin, 1977). Two factors may contribute to that relationship. First, field-independent people, who are characterized by highly developed restructuring skills and an impersonal orientation, may choose to enter, or be chosen for art and music because these domains are especially compatible with their cognitive style (e.g., Witkin, Moore, Goodenough, & Cox, 1977; Witkin, Moore, Oltman, Goodenough, Friedman, & Owen, 1976). As an alternative, education in art and music may enhance restructuring skills. The latter interpretation seems plausible since students in these fields are taught to analyze musical or artistic compositions, but on the basis of correlational studies alone, it is difficult to know whether such training contributes anything to the greater field independence of artists and musicians. Experimental studies are now appearing in the literature, however, in which students assigned to special art or music classes are compared to untrained control groups with regard to posttraining EFT and/or RFT performance (Leithwood & Fowler, 1971; McCord, 1973; McWhinnie, 1967, 1968, 1970b; Parente & O'Malley, 1975; Sutton-Smith, Baracca, Eadie, Mahony, & Zaren, Note 10). The results of these studies are not entirely consistent, but most have supported the training hypothesis.

A number of other studies have examined the effects of more specific perceptual training programs in which extensive general instruction is given in identifying and/or manipulating components of perceptual gestalten (Dolecki, 1976; Hurwitz, Wolff, Bortnick, & Kokas, 1975; McCarter, 1976; McWhinnie, 1967, 1968, 1970b; Reeves, 1971; Szeto, 1975). Significant training effects on EFT performance have been found in most of these studies. Three studies of the Sesame Street television series may also be added here, since one important section of the series involves gamelike demonstrations of perceptual analysis (Diaz-Guerrero & Holtzman, 1974; Ball & Bogatz, Note 11; Salomon, Note 12). Improvement in EFT performance among children who viewed the Sesame Street series has been found in each of these studies.[6]

Two examples of this line of work are worth considering in some detail because they employed well-documented curricula, and because they measured training effects with restructuring material that differed from the training material.

Dolecki (1976) studied the effects of the Project SEE training program (Knobler, Note 14) on Piagetian conservation problems as well as on EFT performance. Project SEE is a perceptual, analytical training program designed for kindergarten and first-grade children. The period of instruction is 15 minutes per day, five days a week, for an entire academic year. During the sequence of class periods, instruction is given in the multidimensional analysis and reproduction of increasingly more complex visual training materials. The design of the study involved post hoc comparisons among three groups of students drawn from a large school district: one group which had received two years of SEE training (kindergarten and 1st grade), a second group which had received only

one year of training (1st grade), and a third group with no training. Significant one-year and two-year training effects were found on conservation and EFT performance both before and after covariance adjustments for a number of entry-level variables including reading readiness skills. These results are particularly interesting because they suggest a generalized enhancement of restructuring ability.

In another interesting study, Hurwitz et al. (1975) examined the effects of musical training by the Kodaly method (Kokas, 1969) on EFT performance. The Kodaly system emphasizes the development of skills in abstracting rhythmic and melodic constructions from folk music. The first-grade children in this study were given 40 minutes of daily Kodaly instruction in school, over a seven-month period. At the end of the training period they were significantly more field independent on the children's EFT than a control group of untrained children matched for age, intelligence and social class. Here again, a generalized enhancement of restructuring ability is indicated.

Still another type of training study has been stimulated by the finding that field-independent people tend to have more developed athletic interests and skills (e.g., Elliott & McMichael, 1963; Meek & Skubie, 1971). Since body sensations are centrally involved in perception of the upright, it is plausible to hypothesize that athletic training will result in more field-independent performance on the RFT and BAT. This hypothesis has been partially supported in training studies with children. Athletic training improved children's RFT performance in one study by Gill, Herdtner, and Lough (1968), but not in another study by David (1975). David did find some evidence

for a training effect on the BAT among fourth and fifth grade boys, but not among girls or third grade children. No training effects were found in a similar study, but the subjects were adult alcoholics (McCarthy, 1967).

Some evidence has also been found that gymnastic training of children may improve performance in figure-ground discrimination (Gill et al., 1968) and identification of embedded figures (Leithwood & Fowler, 1971). These results suggest that athletic training may affect restructuring abilities as well as performance on tests of upright perception. If so, then the training effects may exert their influence at a more general level in our conceptual hierarchy, perhaps even at the level of differentiation. Much more work is needed on this point, but far-reaching implications for the theory of the development of differentiation, as well as for educational practice, would follow from a conclusion that athletic training transfers to a variety of restructuring skills.

The evidence reviewed in this section supports the view that the development of cognitive restructuring skills can be fostered by appropriate educational effort. These findings are exciting, not only because of their educational implications, but because they suggest new methods by which the theory of field dependence may be examined experimentally. If there is a general dimension of restructuring ability which affects performance in a variety of cognitive tasks of disembedding, spatial-visualization, etc., as our hierarchical model suggests, and if general restructuring skills may be taught in appropriate training programs, then transfer of training should be expected throughout the range of restructuring tasks. While the evidence available at this time shows some generalizability, the range of restructuring

behaviors to which training effects may transfer is still uncertain. For this purpose, a wider selection of outcome measures is needed than has been used thus far. In addition, much more needs to be known about how to maximize training outcomes. Beyond all this, research is required on the effects of training upon the expressions of field dependence-independence in interpersonal competencies and autonomy in interpersonal relations. Both common experience and the apparent effects (usually reported in anecdotal form) of practically oriented programs of training in interpersonal behavior suggest that the social aspects of field dependence-independence are amenable to training. Through the various lines of research proposed it may become possible to help people acquire the characteristics associated with both a field-dependent and field-independent mode of functioning, making for mobility in access to the characteristics in which these styles express themselves. We may anticipate that additional evidence on these issues will contribute to the further development of field-dependence theory, as well as to progress toward attainment of practical educational goals.

Child-Rearing Practices

To this point we have been concerned primarily with the effects of training in perception of the upright and cognitive restructuring skills on the development of these components of field dependence-independence. We turn now to influences of a more general kind, likely to affect development at the higher level of self-nonself segregation in the differentiation model.

Our very early work on socialization (Witkin et al., 1962/1974) led us to hypothesize that child-rearing practices which encourage separate autonomous

functioning foster the development of differentiation in general, and more particularly of a field-independent cognitive style. In contrast, child-rearing practices which encourage continued reliance on parental authority are likely to make for less differentiation and a more field-dependent cognitive style. It is not difficult to see how stress on adherence to external standards and continuous reinforcement of such an orientation during growth would work against the emergence of a self that is differentiated from others. On the other hand, stimulating the formation of internalized frames of references, arrived at through the individual's own experience, may plausibly be expected to work in favor of self-nonself segregation.

These hypotheses about socialization practices were suggested in exploratory studies of child-rearing practices and attitudes of mothers of relatively field-dependent and field-independent boys (Dyk & Witkin, 1965; Witkin et al., 1962/1974). Interviews with these mothers identified several ways in which they were different in their handling of the separation issue. More commonly found among mothers of field-dependent than field-independent boys were attitudes and rearing procedures likely to encourage continued connections with her, such as limiting the child's activities in the community; emphasizing conformity; discouraging assertive and aggressive behavior, particularly when directed toward herself; and not stimulating the child to assume responsibilities.

Another observation made in this early exploratory study was that parents of field-dependent children more commonly used severe training as means of controlling their children than did parents of field-independent children. This impression was obtained from the interviews with the mothers and from their children's TAT productions. In their TAT stories, relatively field-dependent

children, more than field-independent ones, portrayed parental figures as punishing children, forcing them to do things they did not want to do, or preventing them from doing things they wanted to do.[7]

These early exploratory studies stimulated considerable research on the role of socialization in the development of field dependence-independence, using a variety of methods and a wide range of subject populations. The weight of this evidence is consistent with the early hypothesis that socialization practices which encourage separation contribute to the development of greater field independence.

One approach to the study of parental behavior has sought retrospective information about childhood experiences from field-dependent and field-independent subjects themselves. Because this approach is economical to use, it has been commonly employed, particularly in cross-cultural studies. While the results of such studies are often lacking in detail, they are of particular interest for their demonstration that parental strictness in socialization is associated with children's field dependence in a wide variety of cultures. The subject populations used in these studies have included Americans (Abelew, 1974); Temne and Mende of Sierra Leone, Africa (Berry, 1966; Dawson, 1967a, 1967b); Hong Kong Chinese (Dawson, Young, & Choi, 1974); Eskimo (Berry, 1966; MacArthur, Note 15, Note 16); West Indians (Vernon, 1965); Zulus (Baran, 1971); and Mexicans (Mebane & Johnson, 1970).

In a second approach to the study of socialization in the development of field dependence-independence, information about child-rearing experiences of subjects was obtained from the parents themselves by means of standardized questionnaires or interviews of varying degree of structure. General measures

of parental attitudes toward child rearing have not shown consistent relations to children's field dependence-independence (Busse, 1969; Claeys & DeBoeck, 1976; Domash, 1973; Hauk, 1967; Lee, 1974; Ribback, 1957). On the other hand, measures from questionnaires or interviews which included questions about parents' actual behavior toward their children have usually related significantly to the cognitive style of their children (Claeys & DeBoeck, 1976; Edgerton, 1975; Irving, 1970; Jones, 1975; Kostlin-Gloger, 1974; Ramirez & Price-Williams, 1974a; Seder, 1957; Tendler, 1975). In most of these studies, questions concerned with extent of encouragement or discouragement of separation and with autonomy distinguished between parents of relatively field-dependent and field-independent children.

The earliest and most elaborate of these studies compared parents of field-dependent and field-independent 10-year-old boys and girls, matched for intelligence (Seder, 1957). Consistent with the results of our own early study, Seder found that field-dependent children, more than field-independent ones, were subjected to coercive child-rearing practices which stressed conformity and authority; had standards set for them by their parents; and were punished for assertive and aggressive behavior.[8]

In still another approach to the study of child-rearing practices, direct observations were made of parents' interactions with field-dependent and field-independent children. Several of these studies examined helping or teaching behavior of parents while their children were working on laboratory tasks. In one study of mother-child dyads from Kenya (Kirk & Burton, Note 17), mothers of field-independent children, compared to mothers of field-dependent ones, were found to use more task-related gestures, and a greater proportion of these gestures were specific single-finger or single-hand movements. In another

study, by Laosa (Note 18), Mexican-American and Anglo-American mothers were observed teaching their children to reproduce a tinker-toy model. With both groups, the behavior of mothers of relatively field-dependent children reflected a greater amount of control and intrusion, compared to the behavior of the mothers of more field-independent children.

Two other observational studies produced less consistent results (Johnston, 1974; Sholtz, 1973). While some teaching-helping behaviors were found to occur more frequently among parents of field-independent children, others did not. One possible basis for these inconsistent results is suggested by the results of a study of Busse (1969). Busse found a nonlinear relation between amount of parental manipulation of the task material and the cognitive style of the child. Parents of field-independent children showed average amounts of manipulation, while parents of field-dependent children either manipulated very little (suggesting that they were not very helpful in training) or very much (suggesting that they took the task over from the child). The view that some mothers of field-dependent children may be particularly dominating was also supported by the finding that they issued more commands than the mothers of field-independent children.

Another observational study considered the family as a whole, focusing particularly on the power structure within families of field-dependent and field-independent children, as assessed by indices of participation, initiation, termination and interruption, in conversations among family members recorded both in the home and in the laboratory (Dreyer, Note 19). The results showed that the parents of field-dependent children strongly dominated

family interactions, whereas in families of field-independent children, power relations varied more from situation to situation and were less stringently structured.

Still another observational study examined parent-infant interactions in relation to the child's cognitive style in later childhood (Dyk, 1969). This longitudinal study is of particular interest because it suggests that socializational practices influencing the development of field dependence-independence may be operative very early in life. Mothers of children who became field dependent or field independent at 6-9 years of age were different in the comforting methods they used in response to distress in their infants. Mothers of infants who developed a relatively field-dependent cognitive style were more likely to use nonspecific modes of comforting, dictated by the mothers's own rather than the baby's needs, and they were prone to be repetitive in their comforting modes from one comforting occasion to another. It seems plausible to imagine that the infant who receives specific feedback, which varies with each of its inner states, is helped to identify and discriminate among needs and feelings within itself, and hence to develop a self which may become an effective referent for behavior.

A second longitudinal study carried out from infancy was done with a small number of cases among the Logoli people in East Africa (Munroe & Munroe, 1975). Infants whose mothers showed longer latency in response to their infants' crying were significantly more field independent around five years of age than infants whose mothers responded quickly. The investigators suggest that the infant who is allowed to cry longer in what they describe as a

society of normally "rapid baby responders" may begin to develop independence early. This difference was not found by Dyk (1969) among American children, however.

We consider finally the question of differences between maternal and paternal roles in the rearing of field-dependent and field-independent boys and girls. Much of the research on this question has been designed to explore the possibility that sex differences in field dependence-independence may be due to sex-role modeling, but it is relevant to socialization of self-nonself segregation as well.

In Western societies and many other cultures the male sex role carries greater autonomy than the female sex role. Through socialization this sex-role difference may be transmitted from one generation to the next. Moreover, as we shall see in a later section, a persuasive case has been made by Berry (1966) and Van Leeuwen (Note 20) that sex differences in measures of field dependence-independence are likely to be pronounced in cultures where sex roles are markedly different and socialization of sex-role stereotypes is emphasized. To the extent that children identify more with the same-sex than with the opposite-sex parent, sex-role modeling may be a major factor in the development of sex differences in field dependence-independence, as has been hypothesized by Lynn (1962, 1969), for example. If so, children (especially boys) of fathers who do not enter actively into the child-rearing process are likely to be relatively field dependent and children (especially girls) of mothers who do not enter actively are likely to be field independent.

The father's role has been examined in numerous studies comparing children from families where the father was absent for various periods during the

child-rearing years with children from intact families (e.g., Barclay & Cusumano, 1967; Lee, 1974; Louden, 1973; Schooler, 1972; Trent, 1974; Wohlford & Liberman, 1970). The weight of the evidence from these studies indicates strongly that father absence leads to greater field dependence among boys, and among girls as well. There is also a variety of data on father's role in intact families. Most of this evidence is consistent with the conclusion that families with strong paternal involvement are more likely to have field-independent sons than families with weak or inattentive fathers (e.g., Busse, 1969; Dawson, 1967b; Dershowitz, 1971; Meizlik, 1973; Dreyer, Note 19).

Another indication that a mother-salient surround is associated with the development of field dependence is the finding of Dawson (1967a, 1967b) that in the polygamous African families he studied, the greater the number of fathers' wives, the more field dependent were the sons. It seems likely that the more numerous his wives, the more limited is the father's relation to any one of his children.

Still another relevant observation is the association found between an extended family structure and field dependence, on the one hand, and a nuclear family structure and field independence, on the other (e.g., Witkin, Price-Williams, Bertini, Christiansen, Oltman, Ramirez, & van Meel, 1974; Holtzman, Diaz-Guerrero, & Swartz, 1975). It is characteristic of the extended family for the grandmother to enter actively into the child-rearing process, thereby making the female role larger than in the typical nuclear family. Moreover, as we shall see in further detail later, cultures which provide a mother-salient surround are likely to be associated with the development of a field-dependent cognitive style.

The effect of maternal absence has been examined in only a few studies and the results have not been consistent (Schooler, 1972; Trent, 1974). There is evidence from intact families, however, that girls who identify less with their mothers (Bieri, 1960; Constantinople, 1974; Nilsson, Almgren, Kohler & Kohler, 1973), or who view their mothers as more rejecting (Minkowich, Note 21), tend to be relatively field independent.

While a sex-role modeling explanation may account for much of the evidence just reviewed, it also seems possible to account for the evidence by assuming that the father's active participation in child-rearing may facilitate the child's separation from the nurturing mother, and thereby provide greater opportunity for autonomous development. There is evidence, for example, that mothers of father-absent families are likely to have particularly protective attitudes toward their children (e.g., Biller, 1971; Lee, 1974); and we may suppose that similar maternal attitudes are likely to exist in intact families in which the father's role is weak. Moreover, to the extent that fathers participate more in raising their sons than their daughters, separation from mother may be facilitated for boys, thus fostering the development of greater field independence among them.

Because the modeling and facilitation-of-separation views of the paternal role lead to similar outcomes, it is difficult to choose between them. Both views, however, imply that socialization plays an important role in the development of sex differences in field dependence-independence.

The weight of the evidence from each of the approaches discussed above is consistent with the conclusion that family environments which encourage separate functioning in children are likely to produce children who develop in

the direction of greater field independence. Further support for this conclusion will be found in subsequent sections, where we examine the role of cultural and ecological factors in the development of field dependence-independence.

Cultural Influences

Evidence on the contribution of the social setting to the development of field dependence-independence comes from a quite recent but already large body of cross-cultural research. This research, reviewed in detail elsewhere (Witkin & Berry, 1975), has followed the strategy of comparing cognitive styles of groups showing a contrast with regard to the social arrangements and social standards conceived as relevant to the development of self-nonself segregation, and thereby, of a more field-dependent or field-independent cognitive style. These cross-cultural studies were undertaken with the hypothesis that members of societies which strongly emphasize conformity would be relatively field dependent, since stress on conformity discourages the development of separate autonomous functioning. On the other hand, members of societies in which there is a greater tolerance of autonomy would be relatively field independent. To put it in capsule form, the societies compared in these studies have differed in what Pelto (1968) has designated social "tightness" or "looseness." Societies at the tight end of the tight-loose dimension are characterized by an elaborate social structure, considerable role diversity, and pressure on the individual to conform with social, religious and political authorities. Societies at the loose end have a less elaborate social structure, fewer roles, and individuals are allowed to "go their own way" to a greater extent. Since the primary means of bringing about the product favored by society lies in socialization in the

family, tight societies are characterized by stress on conformity to parental authority within the family as well, and, with it, use of strict and even harsh socialization practices. Moreover, in families of tight societies, the mother characteristically has a dominant role in the emotional and physical care of the child, whereas the father, while expecting respect and obedience from his children, participates little in these important areas. Thus, members of tight societies should be more field dependent than members of loose societies.

The earliest studies of cognitive styles in groups differing in extent of social conformity were conducted by Berry (1966), with the Temne and Eskimo, and by Dawson (1967a, 1967b), with the Temne and Mende. A great variety of different cultures, and subgroups within the same culture, have been compared in subsequent studies. In one study, for example, children from pairs of villages in each of three countries--Italy, Mexico, Holland--were compared (Witkin et al., 1974). In other studies, the comparisons were between Mexican and American children (Holtzman et al., 1975; Diaz-Guerrero & Holtzman, Note 22); Cuban and American children (Britain & Abad, Note 23); Peruvian and American children (Gruenfeld, Weissenberg, & Loh, 1973); Mexican-American and Anglo-American children (e.g., Buriel, 1975; Kagan, 1974; Ramirez & Price-Williams, 1974b), and between subgroups from within Mexico (Ramirez & Price-Williams, 1974a). Still other comparisons have been made between the Pakeha and Maori (Chapman & Nicholls, 1976); Jews of Middle-Eastern and Western origin, living in Israel (e.g., Amir, 1972, 1975; Preale, Amir, & Sharan, 1970; Weller & Sharan, 1971; Zadik, 1968) or in Europe (Rand, 1975); Jews and non-Jews in the United States (e.g., Adevai, Silverman, & McGough,

1970; Dershowitz, 1971); and Native American Indians and Anglo-Americans (Halverson, 1976). With a high degree of regularity, the results of these studies are consistent with the starting hypothesis relating field dependence-independence to extent of stress on social conformity in the society.

The cross-cultural studies have also shed light on the sources of sex differences in field dependence-independence. These studies have shown that sex differences are more commonplace in tight-conforming than in loose-nonconforming societies (e.g., Holtzman et al., 1975; Kato, 1965; Mebane & Johnson, 1970; Parlee & Rajagopal, 1974; Van Leeuwen, Note 20; Fernandez-Davila, Diaz-Guerrero, & Lara-Tapia, Note 24; Mitchelmore, Note 25). The greater role diversity in tight than in loose societies, including more pronounced differences between male and female roles, the greater emphasis on autonomy in the socialization of boys than of girls, and the stricter enforcement of sex-role expectations, appear to be contributing factors to the more frequently found sex differences in tight societies.

In overview, the expectation that members of cultures and subcultures which are tight in their social organization and stress social conformity would be more field dependent than members of cultures and subcultures which have a loose social organization and place less stress on conformity has received substantial support from the studies reviewed in this section. Though most of the studies did not examine the socialization experiences of subjects themselves, in view of the characteristic child-rearing practices that are an integral component of tight-conforming and loose-nonconforming societies, these studies also lend support to the conclusion reached in the preceding section that child-rearing procedures which stimulate self-nonself

segregation are likely to lead to a field-independent cognitive style. The ecocultural studies reviewed in the next sections provide still further support for that conclusion.

ECOCULTURAL FACTORS IN CULTURAL ADAPTATION AND ONTOGENETIC DEVELOPMENT

There is now a large body of evidence from studies of subsistence-level societies, recently reviewed by Witkin and Berry (1975) and Berry (1976), which indicates that members of nomadic hunting and gathering groups tend to be relatively field independent and members of sedentary agricultural groups relatively field dependent. These findings may be viewed in both a contemporaneous and historic perspective. The issue of interest in the first perspective is the relation between the adaptive demands made on the individual by these contrasting ecologies and development of a more field-dependent or more field-independent cognitive style during ontogeny. The issue of moment in the second perspective is the nature of changes in field dependence-independence over the course of human history.

Obviously, historical changes in field dependence-independence cannot be established directly. There is, however, indirect evidence to suggest a probable progression from a relatively field-independent to a relatively field-dependent cognitive style during cultural development since early times. We know from archeological evidence that for most of their history, members of the human species were nomadic hunters and food gatherers, and that they learned to cultivate crops and domesticate animals perhaps only as recently as 8000 years ago. While there is clearly a limit to what can be determined from archeological evidence, by studying nomadic hunter-gatherer and sedentary

farmer-herder cultures in existence today, we can learn something about the social structures, socialization practices, and cognitive styles that are most compatible with these contrasting economies. From this contemporary evidence it seems plausible to infer that as people moved from hunting to farming economies over the course of human history, the trend in development of cognitive style has been from field independence toward field dependence.

In the sections that follow, we compare mobile hunting and sedentary agricultural groups, first with regard to ecological and cultural features, and then with regard to cognitive style; after that we consider how the inferred historical development from field independence toward field dependence may have come about.

Ecocultural Characteristics of Migratory Hunting and Sedentary Farming Economies

Although subsistence-level groups with similar modes of economic exploitation of their environment have developed a variety of cultural forms, hunting and farming groups are typically different from each other in a number of important, interrelated ecological and cultural characteristics, which may be viewed as products of their economic modes.

Demographically, hunters usually lead a nomadic life, following the game that provides their principal source of food. They travel in relatively small, often family-sized bands, limited in number by the capacity of the local game supply to meet their needs. In contrast agriculturists lead a more sedentary existence, living in villages inhabited by the much larger population made possible by the increase in locally available food (e.g., Murdock, 1969).

Hunting and farming societies also differ in their tendency to accumulate food. Farming groups accumulate food in order to provide subsistence between harvest seasons. In contrast, the typical hunting group soon consumes most of its catch (e.g., Barry, Child, & Bacon, 1959).

Complexity of social structure also distinguishes hunting and farming groups. Migratory hunting societies are characteristically loose, with little permanent, centralized, political or religious authority beyond the family band. Farming societies are typically tight, with limited diversity of social roles, little social stratification, and an emphasis on compliance with social, political, and religious authority (e.g., Berry, 1976; McNett, 1970). The increase in group size and the need to regulate individual consumption between harvests have very likely contributed to the development of more complex and tighter social structures among agriculturists.

Still another difference between hunters and farmers is to be found in the nature of their socialization practices. As might be expected from their tight social structure, sedentary agricultural groups place great emphasis on obedience and compliance in child rearing. In contrast, child rearing in mobile hunting groups is usually characterized by greater emphasis on autonomy and self-reliance (e.g., Barry et al., 1959).

Finally, hunting and farming groups differ in sex-role characteristics. In the smaller, mobile hunting society, with its limited role diversity, the contribution to the economy of women, along with men, is highly valued, with the consequence that obedience in women is not emphasized. In the larger, more complex societies of agriculturists, sex roles are more sharply distinguished

and less value is placed on women's contribution; with these we find particular emphasis on obedience in female socialization (e.g., Berry, 1966; Van Leeuwen, Note 20).

Field Dependence-Independence in Mobile Hunting and Sedentary Farming Societies

From the characterization just given of nomadic hunting and sedentary farming societies, a field-independent cognitive style would appear to be more adaptive for the hunter, and a field-dependent cognitive style for the farmer. The activities involved in hunting and gathering require the ability to extract key information from the surrounding field, usually homogeneous in character, in order to locate game and other food. Moreover, the hunter, in his mobile existence, must be continuously aware of his location in space if he is to return home safely. We may imagine, therefore, that cognitive restructuring skills are particularly adaptive in the life of the hunter-gatherer. In contrast, only minimal social competencies may be required in such an existence. Indeed, the hunter's relatively isolated life may place a premium on individual autonomy (e.g., Berry, 1966, 1976; Dawson, 1969; Witkin & Berry, 1975).

The typical agricultural group is very different in these respects. The more sedentary existence of its members places less demand on cognitive restructuring skills. In contrast, social-interpersonal relationships are likely to be important in the larger social groups in which the farmer lives. It is easy to suppose that the social competencies of field-dependent people would be particularly adaptive in subsistence-level, sedentary farming cultures (Witkin & Berry, 1975).

Given the apparent fit between the adaptive advantages of a field-independent cognitive style and the ecocultural characteristics of a nomadic hunting existence, on the one hand, and between the adaptive advantages of a field-dependent cognitive style and the characteristics of a sedentary agricultural existence, on the other hand, it would not be at all surprising to find members of hunting societies to be more field independent than members of farming societies. The results of many studies with groups from widely different parts of the world give strong support to this expectation.

The most extensive evidence is provided by Berry (1976) in a study which, though only recently reported, has been in progress for some years. Berry combined the economic and demographic variables enumerated in the preceding section into a single ecocultural dimension, typified at one extreme by a nomadic hunting-gathering existence in small groups, and, at the other extreme, by a sedentary-agricultural existence in large settlements. He then examined cognitive styles among members of seventeen different samples ranging along the dimension. The standing of these groups on the field-dependence-independence dimension was in good agreement with their standing on the ecocultural dimension, in the direction predicted. The migratory hunting-gathering groups examined for cognitive style in other more circumscribed studies have included Canadian, Greenland, and Alaskan Eskimo (Berry, 1966; MacArthur, 1975; MacKinnon, 1972; Preston, 1964; Feldman, Note 26); Cree, Athabaskan, Ojibway and Carrier Amerindians (e.g., Berry & Annis, 1974; Kane, 1973; Weitz, 1971); Lapps (Forsius, 1973); the Australian Arunta (Berry, 1971; Dawson, 1969); and the Boat People of Hong Kong (Dawson, 1970). With a high degree of consistency these various groups gave evidence

of being relatively field independent. At the sedentary agricultural end of the ecocultural continuum, the groups studied with regard to field dependence-independence have included the Temne and the Mende of Sierra Leone, Africa (Berry, 1966; Dawson, 1967a, 1967b); Southern Nigerians (Wober, 1967); Bantu-speaking South Africans (Baran, 1971); the Nsenga of Zambia (MacArthur, 1975); the Haka of Hong Kong (Dawson, 1970); Fijians (Chandra, Note 27); and Tsimshian Amerindians (Berry & Annis, 1974). These groups have most often been found to be relatively field dependent.[9]

In view of the nature of the socialization practices represented at each end of the ecocultural dimension, the evidence from these studies provides further support for the conclusions reached earlier about the role of child-rearing in the development of field dependence-independence. By implicating tight vs. loose social organization, these studies also add support to earlier conclusions about the role of cultural factors.

Many of the studies carried out from an ecocultural perspective also suggest that sex differences in field dependence-independence vary with the mode of economic exploitation. Where sex differences have been found, they are largely from samples at the sedentary farming end of the continuum; they tend to be absent from samples at the migratory hunting end (Witkin & Berry, 1975; Van Leeuwen, Note 20). In the economic mode, and, its sequelae, we thus find an additional source of sex differences in field dependence-independence.

Altogether, the results of the studies reviewed in this section clearly support the conclusion that, as expected, nomadic hunting people tend to be more field independent than sedentary farming people, and this difference in cognitive style is particularly pronounced between women in the two settings.

The Historical Development of Field Dependence-Independence

Viewed from an adaptive standpoint, the interrelation among constituents of the contrasting clusters of economic, demographic, cultural, socialization and cognitive-style variables found in hunting and farming societies in existence today seems eminently reasonable. To that extent, the inference that these same variables were similarly interrelated during the history of human cultural development also seems reasonable.

The proposal that the historic sequence was from relative field independence to relative field dependence, as societies moved from a hunting to a farming economic base, leaves open the question of how the change in cognitive style was brought about. In approaching this question, it seems plausible to suppose that a long history of living in the same ecological context, under the pressures of a subsistence level existence, would foster both cultural and biological adaptations to the demands of the ecology.

With regard to cultural adaptation, it is reasonable to believe that the adaptive social structures and socialization practices we have found to exist in nomadic hunting and sedentary farming groups today were the ones favored over the long history of development of these groups. The ecological press thus provided an important early impetus, and a continuing guiding force, in the shaping of cultural forms, through phenotypic transmission, calculated to produce individuals capable of functioning in ways suited to their environment. Cognitive styles may clearly be included among the adaptive ways of functioning.

While biological factors may also have played some role in the evolution of individual cognitive styles, at the moment there is no evidence on this possibility. Several hypotheses may be considered, however.

One hypothesis, proposed by Dawson (1967b), is that the lesser protein intake of farmers, by lowering androgen/estrogen ratios, may make them more field dependent than hunters.

Another hypothesis is suggested by some of the implications of the sex-linked recessive model of spatial-visualization ability examined in an earlier section. Genetic models do not usually lead to the expectation that a recessive allele will produce adaptive phenotypes. The sex-linked recessive model therefore poses a paradox: How, over the course of history, did an adaptive characteristic like spatial-visualization ability come to be favored by a recessive allele? This question has been addressed by Kolakowski and Malina (1974), who suggest that, in early peoples, greater spatial-visualization ability may have had adaptive consequences only for men because of their sex role as hunters. Since an X-linked gene has recessive-dominant properties only for women this suggestion may be of some help in resolving the paradox. However, the model of Kolakowski and Malina cannot easily accommodate the finding that, whereas sex differences in spatial-visualization ability and other restructuring skills have been found in subsistence-level farming cultures in existence today, there has been little evidence of sex difference in subsistence level hunting groups (e.g., Witkin & Berry, 1975; Van Leeuwen, Note 20). If an X-linked recessive gene is involved, these data could be accounted for by assuming that the dominant allele emerged

during evolution from hunting to farming economies. The bipolar aspect of the field-dependence-independence model may then become useful in resolving the paradox through the proposal that a shift occurred in adaptive requirements from the restructuring skills associated with a field-independent cognitive style to the social competencies (i.e., favored by the dominant allele) associated with a field-dependent cognitive style during the transition from hunting to farming economies. As we emphasized earlier, it is unclear at this time whether an X-linked recessive model in fact applies to the field-dependence-independence dimension. If future research indicates that it does, the implications of the assumption that the recessive allele emerged in the transition from hunting to farming economies could be tested empirically in studies of hunting and farming groups in existence today.

Whether or not there is a genetic contribution to individual differences in field dependence-independence, it is quite easy to account for the difference in cognitive style between hunting and farming groups on the basis of ecological, cultural and socialization effects operating during the lifetime of the individual. There is an obvious and even dramatic correspondence between the autonomy-fostering socialization practices typically found in hunting societies and the child-rearing practices that foster the ontogenetic development of a relatively field-independent cognitive style within a given cultural group. In contrast, the socialization practices of the typical farming society, which encourage obedience and limit separation from parental authority, are similar to the child-rearing practices that are associated with the ontogenetic development of a relatively field-dependent cognitive style within cultures. Also

contributing to the development of a field-independent cognitive style among hunters during their life time may be the opportunities provided for direct perceptual learning available to them as they engage in the search for game. Social structure, socialization experiences, and ecological encounters may thus work in tandem toward the same developmental end of producing adaptive modes of behavior in the individual. Certainly, the results of cross-cultural comparisons of migratory hunting and sedentary farming groups are consistent with the conclusion reached in earlier sections that environmental factors operative during ontogeny play a key role in the development of individual differences in cognitive style.

The sex differences in field dependence-independence commonly found in sedentary farming societies, but rarely in nomadic hunting societies, are also readily explained on the basis of ecocultural factors at work during ontogenetic development. The greater distinctiveness of sex roles in agricultural societies, the lesser value placed on women's contribution to the economy, and the more limited opportunity for self-nonself segregation resulting from greater emphasis on obedience in female socialization, make development in a field-dependence direction particularly likely among women in such groups (Van Leeuwen, Note 20).

In considering the relative contributions of cultural and genetic factors in the historic development of field dependence-independence, we may also note that, without doubt, in humans cultural-transmission mechanisms work more quickly and are much more important in producing change than genetic mechanisms (e.g., Cavalli-Sforza & Feldman, 1973a, 1973b). In this perspective the ecocultural changes that occurred in the transition to agricultural economies,

under the impetus of a subsistence-level existence, may have been sufficient to produce the historical changes in the direction of greater field dependence we have postulated.

Some developmental theories implicitly assume that developmental progressions proceed in the same direction during ontogeny and during the history of human adaptation (e.g., Werner, 1948). In contrast, field-dependence theory leads to a quite different expectation. Whereas ontogenetic development proceeds from a state of relative field dependence to a state of relative field independence, cultural development, we have suggested, follows an opposite course. That developmental series may proceed in opposite directions in the case of a cognitive-style dimension is not surprising when we consider that the characteristics at each extreme of the dimension have adaptive value in different situations. As we have suggested, a field-independent cognitive style may have been particularly adaptive to the hunting-gathering existence of early people, whereas a field-dependent cognitive style may have been more adaptive to the sedentary existence of later agricultural groups. Similarly, reliance on external standards, characteristic of a field-dependent cognitive style, seems more suited to the physical and intellectual status of young children, whereas a greater degree of personal autonomy, characteristic of a more field-independent cognitive style, is better suited to adult status. An individual's cognitive style thus appears to be attuned to his capabilities and to the requirements of the environment with which he must cope.

Although the two developmental series may proceed in opposite directions, the question of how this attunement is accomplished may be understood within a single conceptual framework. As we have seen, there is evidence that

specific training effects may contribute to the development of field independence during the life history of the individual, and it is likely that perceptual learning contributes to the field independence of hunters through their nomadic existence and economic pursuits. Socialization practices which encourage separation from parental authority may contribute both to the ontogenetic development of a field-independent cognitive style within a cultural group, as well as to greater field independence among members of early hunting societies than among members of later farming societies. Although the contribution of biological factors to individual differences in field dependence-independence is not yet clear, these factors may also be relevant to both developmental series. It is a major aim of cognitive-style theorists to seek unifying themes which cut across traditional areas of research on human behavior. Though many issues remain to be clarified, as we have noted at numerous points, it is encouraging to find that field-dependence theory provides a means of bringing together within a common conceptual framework areas as diverse as the ones examined in this review.

Reference Notes

1. Witkin, H. A., Cox, P. W., & Friedman, F. Supplement No. 2, Field-dependence-independence and psychological differentiation: Bibliography with index (ETS RB 76-28). Princeton, N.J.: Educational Testing Service, 1976.

2. Witkin, H. A., Cox, P. W., Friedman, F., Hrishikesan, A. G., & Siegel, K. N. Supplement No. 1, Field-dependence-independence and psychological differentiation: Bibliography with index (ETS RB 74-42). Princeton, N.J.: Educational Testing Service, 1974.

3. Witkin, H. A., Oltman, P. K., Cox, P. W., Ehrlichman, E., Hamm, R. M., & Ringler, R. W. Field-dependence-independence and psychological differentiation: A bibliography through 1972 with index (ETS RB 73-62). Princeton, N.J.: Educational Testing Service, 1973.

4. Witkin, H. A., & Goodenough, D. R. Field dependence revisited (ETS RB 76-39). Princeton, N.J.: Educational Testing Service, 1976.

5. Okonji, M. O., & Olagbaiye, O. O. Egocentrism and psychological differentiation: A cross-cultural perspective. Paper presented at the Second International Conference of the International Association for Cross-Cultural Psychology, Kingston, Ontario, Canada, August 1974.

6. Nyborg, H. Sex chromosome abnormalities and cognitive performance. I: A developmental study of cognitive performance in girls with Turner's Syndrome (Psychological Reports Aarhus, Vol. 1, No. 2). Risskov, Denmark: University of Aarhus, Institute of Psychology, 1976.

7. Serra, A., Pizzamiglio, L., Boari, A., & Spera, S. A comparative study of cognitive traits in human heterosomic aneuploids and sterile and fertile euploids. Manuscript submitted for publication, 1976.

8. O'Connor, J. Structural visualization. Boston: Human Engineering Laboratory, 1943.

9. Witkin, H. A. The effect of training and of structural aids on performance in three tests of space orientation. Report No. 80. Washington, D. C.: Civil Aeronautics Administration, Division of Research, 1948.

10. Sutton-Smith, B., Baracca, F., Eadie, F., Mahony, D., & Zaren, S. A developmental psychology of children's film making. Paper presented at the 1977 Conference on Culture and Communication, Temple University, Philadelphia, March 1977.

11. Ball, S., & Bogatz, G. A. The first year of Sesame Street: An evaluation (ETS PR 70-15). Princeton, N.J.: Educational Testing Service, 1970.

12. Salomon, G. Cognitive effects of media: The case of "Sesame Street" in Israel. Paper presented at the meeting of the International Society for the Study of Behavioral Development, Ann Arbor, Mich., August 1973.

13. Banta, T. J. Progress report: The Montessori research project. Cincinnati, Ohio: University of Cincinnati, 1966.

14. Knobler, M. Teacher's guide to Project SEE. Union, N.J.: Union Township Board of Education, 1971.

15. MacArthur, R. S. Cognition and psychosocial influences for Eastern Eskimos and Nsenga Africans: Some preliminaries. Paper presented at the Memorial University of Newfoundland Symposium on Cross-Cultural Research, St. John's, October 1970.

16. MacArthur, R. S. Mental abilities and psychosocial environments: Igloolik Eskimos. Paper presented at Mid-Project Review, International Biological Programme, Igloolik Project, Toronto, March 1971.

17. Kirk, L., & Burton, M. Maternal kinesic behavior and cognitive development in the child. In F. Denmark (Chair), Special aspects of cross-cultural research. Symposium presented at the meeting of the New York Academy of Sciences, New York, October 1975.

18. Laosa, L. M. Teaching problem-solving to their young children: Strategies used by Mexican-American and Anglo-American mothers. Preliminary analyses. Paper presented at the meeting of the Interamerican Congress Psychology, Miami Beach, Florida, December 1976.

19. Dreyer, A. S. Family interaction and cognitive style: Situation and cross-sex effects. In H. B. Biller (Chair), Beyond father absence: Conceptualization of father effects. Symposium presented at the meeting of the Society for Research in Child Development, Denver, April 1975.

20. Van Leeuwen, M. S. Culture as a crucible for examining sex differences in cognitive style. Paper presented at the meeting of the American Psychological Association, Chicago, August 1975.

21. Minkowich, A. Correlates of ambivalence, risk-taking and rigidity. (Final Scientific Report No. 3, Grant AF EOAR 65-32) European Office of Aerospace Research: United States Air Force, Air Force Office of Scientific Research, 1967.

22. Diaz-Guerrero, R., & Holtzman, W. H. Cognitive perceptual style development in two cultures: Mexico and the U.S. In H. Witkin (Chair), Cross-cultural studies of psychological differentiation. Symposium presented at the meeting of the International Association for Cross-Cultural Psychology, Kingston, Ontario, August 1974.

23. Britain, S. D., & Abad, M. Field-independence: A function of sex and socialization in a Cuban and an American group. Paper presented at the meeting of the American Psychological Association, New Orleans, September 1974.

24. Fernandez-Davila, M. D. L. L., Diaz-Guerrero, R., & Lara-Tapia, L. Primera fase en las investigacion de la prueba de figuras ocultas de Witkin en escolares Mexicanos. Paper presented at the meeting of the Interamerican Congress of Psychology, Lima, Peru, 1966.

25. Mitchelmore, M. C. The influence of sex and culture on spatial ability. Unpublished manuscript, Ohio State University, 1973.

26. Feldman, C. F. Cognitive development in Eskimos. Paper presented at the meeting of the Society for Research in Child Development, Minneapolis, Minnesota, April 1971.

27. Chandra, S. Cognitive development - Indians and Fijians. Paper presented at the Second International Conference of the International Association for Cross-Cultural Psychology, Kingston, Ontario, Canada, August 1974.

References

Abelew, T. Sex role attitudes, perceptual style, mathematical ability and perceived parental child-rearing attitudes in adolescents (Doctoral dissertation, Fordham University, 1974). Dissertation Abstracts International, 1974, 35, 1439B. (University Microfilms No. 74-19,696)

Adevai, G., Silverman, A. J., & McGough, W. E. Ethnic differences in perceptual testing. International Journal of Social Psychiatry, 1970, 16, 237-239.

Amir, Y. Inter- and intra-ethnic comparisons of intellectual functions in Israeli and Middle Eastern populations. Abstract Guide of the Twentieth International Congress of Psychology, Tokyo, 1972, 175-176.

Amir, Y. Perceptual articulation in three Middle Eastern cultures. Journal of Cross-Cultural Psychology, 1975, 6, 406-416.

Assawamatiyanont, S. The relationship between psychological differentiation and egocentrism (Doctoral dissertation, Ohio State University, 1971). Dissertation Abstracts International, 1971, 32, 1816B-1817B. (University Microfilms No. 71-22,443)

Baran, S. Development and validation of a TAT-type projective test for use among Bantu-speaking people (CSIR Special Report No. PERS 138). Johannesburg, South Africa: National Institute for Personnel Research Council for Scientific and Industrial Research, 1971.

Barclay, A., & Cusumano, D. R. Father absence, cross-sex identity, and field-dependent behavior in male adolescents. Child Development, 1967, 38, 243-250.

Bard, C. The relation between perceptual style and physical activities. International Journal of Sports Psychology, 1972, 3, 107-113.

Barry, H., Child, I. L., & Bacon, M. K. Relation of child training to subsistence economy. American Anthropologist, 1959, 61, 51-63.

Bell, D. R., & McManis, D. L. Perceptual differences of subjects classified as reward seekers and punishment avoiders. Perceptual and Motor Skills, 1968, 27, 51-56.

Bercovici, A. M. The influence of aggressive and non-aggressive television and cognitive style on elementary and junior high school children. Unpublished master's thesis, University of California, Los Angeles, 1970.

Berry, J. W. Temne and Eskimo perceptual skills. International Journal of Psychology, 1966, 1, 207-229.

Berry, J. W. Ecological and cultural factors in spatial perceptual development. Canadian Journal of Behavioural Science, 1971, 3, 324-336.

Berry, J. W. Human ecology and cognitive style: Comparative studies in cultural and psychological adaptation. New York: Wiley, 1976.

Berry, J. W., & Annis, R. C. Ecology, culture and psychological differentiation. International Journal of Psychology, 1974, 9, 173-193.

Bieri, J. Parental identification, acceptance of authority, and within-sex differences in cognitive behavior. Journal of Abnormal and Social Psychology, 1960, 60, 76-79.

Biller, H. B. The mother-child relationship and father-absent boy's personality development. Merrill-Palmer Quarterly, 1971, 17, 227-241.

Birmingham, D. L. Situational and personality factors in conformity (Doctoral dissertation, Saint Louis University, 1974). Dissertation Abstracts International, 1974, 35, 2421B. (University Microfilms No. 74-24,042)

Bock, R. D., & Kolakowski, D. Further evidence of sex-linked major-gene influence on human spatial visualizing ability. American Journal of Human Genetics, 1973, 25, 1-14.

Brinkmann, E. H. Programmed instruction as a technique for improving spatial visualization. Journal of Applied Psychology, 1966, 50, 179-184.

Broverman, D. M., Broverman, I. K., Vogel, W., Palmer, R. D., & Klaiber, E. L. The automatization cognitive style and physical development. Child Development, 1964, 35, 1343-1359

Broverman, D. M., & Klaiber, E. L. Negative relationships between abilities. Psychometrika, 1969, 34, 5-20.

Broverman, D. M., Klaiber, E. L., Kobayashi, Y. & Vogel, W. Roles of activation and inhibition in sex differences in cognitive abilities. Psychological Review, 1968, 75, 23-50.

Buriel, R. Cognitive styles among three generations of Mexican American children. Journal of Cross-Cultural Psychology, 1975, 6, 417-429.

Busse, T. V. Child-rearing antecedents of flexible thinking. Developmental Psychology, 1969, 1, 585-591.

Cavalli-Sforza, L., & Feldman, M. W. Cultural versus biological inheritance: Phenotypic transmission from parent to children. (A theory of the effect of parental phenotypes on children's phenotype.) American Journal of Human Genetics, 1973, 25, 618-634. (a)

Cavalli-Sforza, L., & Feldman, M. W. Models for cultural inheritance I. Group mean and within group variation. Theoretical Population Biology, 1973, 4, 42-55. (b)

Chapman, J. W., & Nicholls, J. G. Occupational identity status, occupational preference, and field dependence in Maori and Pakeha boys. Journal of Cross-Cultural Psychology, 1976, 7, 61-72.

Churchill, R. D., Curtis, J. M., Coombs, C. H., & Harrell, T. W. Effect of engineer school training on the Surface Development Test. Educational and Psychological Measurement, 1942, 2, 279-280.

Clack, G. S. Effects of social class, age, and sex on tests of perception, affect discrimination, and deferred gratification in children (Doctoral dissertation, Washington University, 1970). Dissertation Abstracts International, 1970, 31, 2275B. (University Microfilms No. 70-18,918)

Claeys, W., & DeBoeck, P. The influence of some parental characteristics on children's primary abilities and field independence: A study of adopted children. Child Development, 1976, 47, 842-845.

Coates, S. W. Preschool embedded figures test manual. Palo Alto, Calif.: Consulting Psychologists Press, 1972.

Coates, S. Sex differences in field independence among preschool children. In R. C. Friedman, R. M. Richart, & R. L. Vande Wiele (Eds.), Sex differences in behavior. New York: Wiley, 1974.

Coates, S. Field independence and intellectual functioning in preschool children. Perceptual and Motor Skills, 1975, 41, 251-254.

Coates, S., Lord, M., & Jakabovics, E. Field dependence-independence, social-non-social play and sex differences in preschool children. Perceptual and Motor Skills, 1975, 40, 195-202.

Constantinople, A. Analytical ability and perceived similarity to parents. Psychological Reports, 1974, 35, 1335-1345.

Corah, N. L. Differentiation in children and their parents. Journal of Personality, 1965, 33, 300-308.

David, R. B. Sensitivity of body cues and the field dependence-independence continuum (Doctoral dissertation, Columbia University, 1975). Dissertation Abstracts International, 1976, 37, 950B. (University Microfilms No. 76-18,465)

Dawson, J. L. M. Kwashiorkor, Gynaecomastia, and feminization processes. Journal of Tropical Medicine and Hygiene, 1966, 69, 175-179.

Dawson, J. L. M. Cultural and physiological influences upon spatial-perceptual processes in West Africa - Part I. International Journal of Psychology, 1967, 2, 115-128. (a)

Dawson, J. L. M. Cultural and physiological influences upon spatial-perceptual processes in West Africa - Part II. International Journal of Psychology, 1967, 2, 171-185. (b)

Dawson, J. L. M. Theoretical and research bases of bio-social psychology. University of Hong Kong, Supplement to the Gazette, 1969, 16, 1-10.

Dawson, J. L. M. Psychological research in Hong Kong. International Journal of Psychology, 1970, 5, 63-70.

Dawson, J. L. M. Effects of sex hormones on cognitive style in rats and men. Behavior Genetics, 1972, 2, 21-42.

Dawson, J. L. M., Young, B. M., & Choi, P. P. C. Developmental influences in pictorial depth perception among Hong Kong Chinese children. Journal of Cross-Cultural Psychology, 1974, 5, 3-22.

DeFries, J. C., Ashton, G. C., Johnson, R. C., Kuse, A. R., McClearn, G. E., Mi, M. P., Rashad, M. N., Vandenberg, S. G., & Wilson, J. R. Parent-offspring resemblance for specific cognitive abilities in two ethnic groups. Nature, 1976, 261, 131-133.

Dengerink, H. A., O'Leary, M. R., & Kasner, K. H. Individual differences in aggressive responses to attack: Internal-external locus of control and field dependence-independence. Journal of Research in Personality, 1975, 9, 191-199.

Dershowitz, Z. Jewish subcultural patterns and psychological differentiation. International Journal of Psychology, 1971, 6, 223-231.

Diaz-Guerrero, R., & Holtzman, W. H. Learning by televised "Plaza Sesamo" in Mexico. Journal of Educational Psychology, 1974, 66, 632-643.

Dickie, K. E. Effects of compressing visual information and field-dependence on acquiring a procedural skill (Doctoral dissertation, Indiana University, 1969). Dissertation Abstracts International, 1970, 31, 662A. (University Microfilms No. 70-11,683)

Doherty, M. A. Relationship of the global-analytical and open-closed dimensions within and between the sexes in cognitive activity. Unpublished doctoral dissertation, Loyola University of Chicago, 1968.

Dolecki, P. G. The effects of a perceptual training program on conservation task performance and field independence in first grade children (Doctoral dissertation, Rutgers University, 1976). Dissertation Abstracts International, 1976, 37, 878A. (University Microfilms No. 76-17,311)

Domash, L. G. Selected maternal attitudes as related to sex, sex-role preference and level of psychological differentiation of the five year old child (Doctoral dissertation, New York University, 1973). Dissertation Abstracts International, 1973, 34, 2925B. (University Microfilms No. 73-30,059)

Dreyer, A. S., Dreyer, C. A., & Nebelkopf, E. B. Portable rod-and-frame test as a measure of cognitive style in kindergarten children. Perceptual and Motor Skills, 1971, 33, 775-781.

Duvall, N. S. Field articulation and the repression-sensitization dimension in perception and memory (Doctoral dissertation, University of North Carolina at Chapel Hill, 1969). Dissertation Abstracts International, 1970, 30, 3864B. (University Microfilms No. 70-3228)

Dyk, R. B. An exploratory study of mother-child interaction in infancy as related to the development of differentiation. Journal of the American Academy of Child Psychiatry, 1969, 8, 657-691.

Dyk, R. B., & Witkin, H. A. Family experiences related to the development of differentiation in children. Child Development, 1965, 30, 21-55.

Eagle, M., Goldberger, L., & Breitman, M. Field dependence and memory for social vs neutral and relevant vs irrelevant incidental stimuli. Perceptual and Motor Skills, 1969, 29, 903-910.

Eddy, S. The relationship of field articulation to delay capacity in children (Doctoral dissertation, Boston University, 1974). Dissertation Abstracts International, 1974, 35, 2988B. (University Microfilms No. 74-26,441)

Edgerton, N. E. The relationship of cognitive style of young children to maternal child-rearing practices (Doctoral dissertation, Florida State University, 1975). Dissertation Abstracts International, 1976, 36, 5135A. (University Microfilms No. 76-2638)

Efland, A. D. The effect of perceptual training upon the differentiation of form in children's drawings (Doctoral dissertation, Stanford University, 1965). Dissertation Abstracts, 1966, 26, 3753. (University Microfilms No. 65-12,732)

Elliott, R., & McMichael, R. E. Effects of specific training on frame dependence. Perceptual and Motor Skills, 1963, 17, 363-367.

Finley, G. E., & Solla, J. Birth order and field dependence-independence: A failure to replicate. Journal of Genetic Psychology, 1975, 126, 305-306.

Fitzgibbons, D. J., & Goldberger, L. Task and social orientation: A study of field dependence, "arousal," and memory for incidental material. Perceptual and Motor Skills, 1971, 32, 167-174.

Forsius, H. The Finnish Skolt Lapp children. Acta Paediatrica Scandinavica Supplement, 1973, 239, 1-74.

Gaines, R. Developmental perception and cognitive styles: From young children to master artists. Perceptual and Motor Skills, 1975, 40, 983-998.

Gardner, R. W., Holzman, P. S., Klein, G. S., Linton, H. B., & Spence, D. P. Cognitive control: A study of individual consistencies in cognitive behavior. Psychological Issues, 1959, 1 (4, Monograph 4).

Gardner, R. W., Jackson, D. N., & Messick, S. J. Personality organization in cognitive controls and intellectual abilities. Psychological Issues, 1960, 2, (4, Whole No. 8).

Geffen, L. F. Relationships between visual deficiencies and cognitive factors before and after tachistoscopic training (Doctoral dissertation, George Peabody College for Teachers, 1971). Dissertation Abstracts International, 1971, 32, 1941A. (University Microfilms No. 71-26,207)

Gill, N. T., Herdtner, T. J., & Lough, L. Perceptual and socio-economic variables, instruction in body-orientation, and predicted academic success in young children. Perceptual and Motor Skills, 1968, 26, 1175-1184.

Goldstein, A. G., & Chance, J. E. Effects of practice on sex-related differences in performance on Embedded Figures. Psychonomic Science, 1965, 3, 361-362.

Goodenough, D. R., Gandini, E., Olkin, I., Pizzamiglio, L., Thayer, D., & Witkin, H. A. A study of X-chromosome linkage with field dependence and spatial-visualization. Behavior Genetics, 1977, 7, 373-387.

Goodenough, D. R., & Karp, S. A. Field dependence and intellectual functioning. Journal of Abnormal and Social Psychology, 1961, 63, 241-246.

Gottschaldt, L. Über den einfluss der erfährung auf die wahrnehmung von figuren 1: Über den einfluss gehäufter einprägung von figuren auf ihre sichtbarkeit in umfassenden konfigurationen. Psychol. Forsch., 1926, 8, 261-317.

Greene, L. R. Effects of field independence, physical proximity and evaluative feedback on affective reactions and compliance in a dyadic interaction (Doctoral dissertation, Yale University, 1973). Dissertation Abstracts International, 1973, 34, 2284B-2285B. (University Microfilms No. 73-26,285)

Greenfield, N. L. Field independence-dependence and bargaining behavior. Unpublished master's thesis, Cornell University, 1969.

Gruenfeld, L. W., Weissenberg, P., & Loh, W. Achievement values, cognitive style and social class: A cross-cultural comparison of Peruvian and U.S. students. International Journal of Psychology, 1973, 8, 41-49.

Grunebaum, H., Weiss, J. L., Gallant, D., & Cohler, B. J. Attention in young children of psychotic mothers. American Journal of Psychiatry, 1974, 131, 887-891.

Halverson, V. B. Cognitive styles of preschool Seminole Indian children (Doctoral dissertation, Florida State University, 1976). Dissertation Abstracts International, 1977, 37, 4198A-4199A. (University Microfilms No. 76-29,446)

Hartlage, L. C. Sex-linked inheritance of spatial ability. Perceptual and Motor Skills, 1970, 31, 610.

Hauk, M. W. Effects of maternal attitudes, field-dependence and curiosity on weight and volume conservation in children (Doctoral dissertation, Catholic University of America, 1967). Dissertation Abstracts, 1967, 28, 2642B. (University Microfilms No. 67-15,463)

Holley, M. Field-dependence-independence, sophistication-of-body-concept, and social distance selection (Doctoral dissertation, New York University, 1972). Dissertation Abstracts International, 1972, 33, 296B. (University Microfilms No. 72-20,635)

Holtzman, W. H., Diaz-Guerrero, R., & Swartz, J. D. Personality development in two cultures: A cross-cultural longitudinal study of school children in Mexico and the United States. Austin, Texas: University of Texas Press, 1975.

Hurwitz, I., Wolff, P. H., Bortnick, B. D., & Kokas, K. Nonmusical effects of the Kodaly music curriculum in primary grade children. Journal of Learning Disabilities, 1975, 8, 167-174.

Hyde, J. S., Geiringer, E. R., & Yen, W. M. On the empirical relation between spatial ability and sex differences in other aspects of cognitive performance. Multivariate Behavioral Research, 1975, 10, 289-309.

Irving, D. D. The field-dependence hypothesis in cross-cultural perspective (Doctoral dissertation, Rice University, 1970). Dissertation Abstracts International, 1970, 31, 3691B. (University Microfilms No. 70-23,529)

Johnston, P. K. Relationship between perceptual style, achievement, and childrearing practices in elementary-school boys and girls (Doctoral dissertation, University of Southern California, 1974). Dissertation Abstracts International, 1974, 34, 5169B-5170B. (University Microfilms No. 74-9070)

Jones, P. A. Socialization practices and the development of spatial ability. In J. L. M. Dawson & W. J. Lonner (Eds.), Readings in cross-cultural psychology. Hong Kong: Hong Kong University Press, 1975.

Justice, M. T. Field dependency, intimacy of topic and interperson distance (Doctoral dissertation, University of Florida, 1969). Dissertation Abstracts International, 1970, 31, 395B-396B. (University Microfilms No. 70-12,243)

Kagan, S. Field dependence and conformity of rural Mexican and urban Anglo-American children. Child Development, 1974, 45, 765-771.

Kane, J. R. Perceptual differentiation in Ojibway and white populations. Unpublished bachelor's thesis, Queens University, 1973.

Karp, S. A., & Konstadt, N. The Children's Embedded Figures Test (CEFT). In Witkin, H. A., Oltman, P. K., Raskin, E., & Karp, S. A., Manual for the Embedded Figures Tests. Palo Alto, Calif.: Consulting Psychologists Press, 1971.

Kato, N. A fundamental study of rod frame test. Japanese Psychological Research, 1965, 7, 61-68.

Klaiber, E. L., Broverman, D. M. & Kobayashi, Y. The automatization cognitive style, androgens, and monoamine oxidase. Psychopharmacologia, 1967, 11, 320-336.

Klepper, I. L. Induction of field-dependence changes by body attention procedures. Perceptual and Motor Skills, 1969, 29, 139-145.

Kokas, K. Psychological tests in connection with music education in Hungary. Journal of Research in Music Education, 1969, 8, 102-114.

Kolakowski, D., & Malina, R. M. Spatial ability, throwing accuracy and man's hunting heritage. Nature, October 4, 1974, pp. 410-412.

Kostlin-Gloger, G. Sozialisation und kognitive stile. Weinheim, Germany: Beltz, 1974.

Lee, S. W. Effects of temporary father-absence and parental child rearing attitudes on the development of cognitive abilities among elementary school boys (Doctoral dissertation, University of Texas at Austin, 1974). Dissertation Abstracts International, 1974, 35, 483B. (University Microfilms No. 74-14,728)

Leithwood, K. A., & Fowler, W. Complex motor learning in four-year-olds. Child Development, 1971, 42, 781-792.

Linton, H. B. Dependence on external influence: Correlates in perception, attitudes, and judgment. Journal of Abnormal and Social Psychology, 1955, 51, 502-507.

Louden, K. H. Field dependence in college students as related to father absence during the latency period. Unpublished doctoral dissertation, Fuller Theological Seminary, 1973.

Lynn, D. B. Sex-role and parental identification. Child Development, 1962, 33, 555-564.

Lynn, D. B. Curvilinear relation between cognitive functioning and distance of child from parent of the same sex. Psychological Review, 1969, 76, 236-240.

MacArthur, R. S. Differential ability patterns: Inuit, Nsenga, Canadian whites. In J. W. Berry & W. J. Lonner (Eds.), Applied cross-cultural psychology. Amsterdam: Swets & Zeitlinger, 1975.

Maccoby, E. E., & Jacklin, C. N. The psychology of sex differences. Stanford, Calif.: Stanford University Press, 1974.

MacKinnon, A. A. Eskimo and Caucasian: A discordant note on cognitive-perceptual abilities. Proceedings of the 80th Annual Convention of the American Psychological Association, 1972, 7, 303-304. (Summary)

MacKinnon, D. W. The personality correlates of creativity: A study of American architects. In G. Nielson (Ed.), Proceedings of the 14th International Congress of Applied Psychology (Vol. 2). Personality Research. Copenhagen, Denmark: Munksgaard, 1962.

McCain, F. E. The effect of figural and verbal task demands during observation training on field articulation in prospective teachers (Doctoral dissertation, Indiana University, 1970). Dissertation Abstracts International, 1971, 31, 3964A. (University Microfilms No. 70-23,370)

McCarter, S. C. A description of altered visual perceptual differentiation as affected by instructional procedures upon the responses of individuals to visual data (Doctoral dissertation, North Texas State University, 1976). Dissertation Abstracts International, 1976, 37, 3352A-3353A. (University Microfilms No. 76-29,152)

McCarthy, R. J. A study of the effect of rail walking on improvement of rod and frame performance of alcoholics. Unpublished master's thesis, University of Kansas, 1967.

McCord, M. M. Comparative effects of selected art experiences upon factors of visual perception (Doctoral dissertation, Indiana University, 1973). Dissertation Abstracts International, 1974, 34, 4880A-4881A. (University Microfilms No. 74-2680)

McFie, J. The effect of education on African performance on a group of intellectual tests. British Journal of Educational Psychology, 1961, 31, 232-240.

McGuire, L. S., Ryan, K. O., & Omenn, G. S. Congenital adrenal hyperplasia. II. Cognitive and behavioral studies. Behavior Genetics, 1975, 5, 175-188.

McNett, C. W. A settlement pattern scale of cultural complexity. In R. Naroll & R. Cohen (Eds.), A handbook of method in cultural anthropology. New York: Natural History Press, 1970.

McWhinnie, H. J. The effects of a learning experience upon the preference for complexity and asymmetry in fourth grade children. California Journal of Educational Research, 1967, 18, 219-229.

McWhinnie, H. J. The effects of a learning experience upon the preference for complexity and asymmetry in fifth grade children. California Journal of Educational Research, 1968, 19, 183-189.

McWhinnie, H. J. A factor analytic study of perceptual behavior in 4th and 5th grade children. Acta Psychologica, 1970, 34, 89-97. (a)

McWhinnie, H. J. A third study of the effects of a learning experience upon preference for complexity-asymmetry in fourth, fifth, and sixth grade children. California Journal of Educational Research, 1970, 21, 216-225. (b)

Mebane, D., & Johnson, D. L. A comparison of the performance of Mexican boys and girls on Witkin's cognitive tasks. Interamerican Journal of Psychology, 1970, 4, 227-239.

Meek, F., & Skubie, V. Spatial perception of highly skilled and poorly skilled females. Perceptual and Motor Skills, 1971, 33, 1309-1310.

Meizlik, F. The effect of sex and cultural variables on field independence/dependence in a Jewish subculture. Unpublished master's thesis, City University of New York, 1973.

Miller, L. B., & Dyer, J. L. Four preschool programs: Their dimensions and effects. Monographs of the Society for Research in Child Development, 1975, 40 (5-6, Serial No. 162).

Money, J. Cognitive deficits in Turner's syndrome. In S. G. Vandenberg (Ed.), Progress in human behavior genetics. Baltimore, Maryland: Johns Hopkins, 1968.

Money, J., & Alexander, D. Turner's syndrome: Further demonstration of the presence of specific cognitional deficiencies. Journal of Medical Genetics, 196[illegible], 3, 47-48.

Munroe, R. H., & Munroe, R. L. Infant care and childhood performance in East Africa. Paper presented at the meeting of the Society for Research in Child Development, Denver, April 1975. (ERIC Document Reproduction Service No. ED 115 369)

Murawski, B. J., & Jones, K. J. Correlation of somatic, biochemical, perceptual, and Rorschach data on forty healthy male subjects. Psychophysiology, 1970, 6, 761-772.

Murdock, G. P. Correlations of exploitative and settlement patterns. In D. Damas (Ed.), Ecological essays. National Museum of Canada Bulletin No. 230, Anthropological Series No. 86, 1969.

Nedd, A. N. B., & Gruenfeld, L. W. Field dependence-independence and social traditionalism: A comparison of ethnic subcultures of Trinidad. International Journal of Psychology, 1976, 11, 23-41.

Nilsson, A., Almgren, P. E., Kohler, E. M., & Kohler, L. Enuresis: The importance of maternal attitudes and personality. Acta Psychiatrica Scandinavica, 1973, 49, 114-130.

Oliver, R. A. Parental influence on children's cognitive style (Doctoral dissertation, Iowa State University, 1974). Dissertation Abstracts International, 1974, 35, 485B. (University Microfilms No. 74-15,443)

Oltman, P. K., Goodenough, D. R., Witkin, H. A., Freedman, N., & Friedman, F. Psychological differentiation as a factor in conflict resolution. Journal of Personality and Social Psychology, 1975, 32, 730-736.

Parente, J. A., & O'Malley, J. J. Training in musical rhythm and field dependence of children. Perceptual and Motor Skills, 1975, 40, 392-394.

Parlee, M. B. Comments on "Roles of activation and inhibition in sex differences in cognitive abilities" by D. M. Broverman, E. L. Klaiber, Y. Kobayshi, and W. Vogel. Psychological Review, 1972, 79, 180-184.

Parlee, M. B., & Rajagopal, J. Sex differences on the embedded-figures test: A cross-cultural comparison of college students in India and in the United States. Perceptual and Motor Skills, 1974, 39, 1311-1314.

Pascual-Leone, J. Cognitive development and cognitive style: A general psychological integration. Unpublished doctoral dissertation, University of Geneva, 1969.

Pearlstein, L. S. The relationships between intelligence and cognitive style and the creative ability of kindergarten age children. Unpublished master's thesis, University of Connecticut, 1971.

Pelto, P. J. The differences between "tight" and "loose" societies. Transaction, 1968, April, 37-40.

Perez, P. P. Experimental instructions and stimulus content as variables in the size constancy perception of schizophrenics and normals (Doctoral dissertation, New York University, 1955). Dissertation Abstracts, 1958, 18, 2214-2215. (University Microfilms No. 24,888)

Petersen, A. C. The relationship of androgenicity in males and females to spatial ability and fluent production. Unpublished doctoral dissertation, University of Chicago, 1973.

Petersen, A. C. Physical androgyny and cognitive functioning in adolescence. Developmental Psychology, 1976, 12, 524-533.

Preale, I., Amir Y., & Sharan, S. Perceptual articulation and task effectiveness in several Israel subcultures. Journal of Personality and Social Psychology, 1970, 15, 190-195.

Preston, C. E. Psychological testing with Northwest Coast Alaskan Eskimos. Genetic Psychology Monographs, 1964, 69, 323-419.

Quinlan, D. M., & Blatt, S. J. Field articulation and performance under stress: Differential predictions in surgical and psychiatric nursing training. Journal of Consulting and Clinical Psychology, 1972, 39, 517.

Ramirez, M., & Price-Williams, D. Cognitive styles in children: Two Mexican communities. Interamerican Journal of Psychology, 1974, 8, 93-101. (a)

Ramirez, M., III, & Price-Williams, D. R. Cognitive styles of children of three ethnic groups in the United States. Journal of Cross-Cultural Psychology, 1974, 5, 212-219. (b)

Rand, Y. Dependance a l'egard du champ et appartenance culturelle. Monographies Francaises de Psychologie, No. 28. Paris: Centre National de la Recherche Scientifique, 1975.

Randolph, L. C. A study of the effects of praise, criticism and failure on the problem solving performance of field-dependent and field-independent individuals (Doctoral dissertation, New York University, 1971). Dissertation Abstracts International, 1971, 32, 3014B-3015B. (University Microfilms No. 71-28,555)

Reeves, D. J. The assessment of altered differentiation as affected by experimental treatments (Doctoral dissertation, Illinois State University, 1971). Dissertation Abstracts International, 1971, 32, 253A. (University Microfilms No. 71-18,131)

Renzi, N. B. A study of some effects of field dependence-independence and feedback on performance achievement (Doctoral dissertation, Hofstra University, 1974). Dissertation Abstracts International, 1974, 35, 2059A. (University Microfilms No. 74-21,861)

Ribback, B. H. B. Factors related to the perceptual-analytic ability of children (Doctoral dissertation, Purdue University, 1957). Dissertation Abstracts, 1957, 18, 302. (University Microfilms No. 24,396)

Rosenberg, E. S. Some psychological and biological relationships between masculinity and femininity and field dependence and field independence (Doctoral dissertation, Northwestern University, 1975). Dissertation Abstracts International, 1976, 36, 6453B. (University Microfilms No. 76-13,106)

Ruble, D. N., & Nakamura, C. Y. Task orientation versus social orientation in young children and their attention to relevant social cues. Child Development, 1972, 43, 471-480.

Schaffer, M. C. Parent-child similarity in psychological differentiation (Doctoral dissertation, Purdue University, 1969). Dissertation Abstracts International, 1969, 30, 1888B. (University Microfilms No. 69-17,253)

Schooler, C. Childhood family structure and adult characteristics. Sociometry, 1972, 35, 255-269.

Seder, J. A. The origin of differences in extent of independence in children: Developmental factors in perceptual field dependence. Unpublished bachelor's thesis, Radcliffe College, 1957.

Shaffer, J. W. A specific cognitive deficit observed in gonadal aplasia (Turner's syndrome). Journal of Clinical Psychology, 1962, 18, 403-406.

Sherman, J. A. On the psychology of women: A survey of empirical studies. Springfield, Ill.: Thomas, 1971.

Sholtz, D. The development of sex differences in field independence (Doctoral dissertation, Boston University, 1973). Dissertation Abstracts International, 1973, 33, 6066B-6067B. (University Microfilms No. 73-14,180)

Singer, G., & Montgomery, R. B. Comment on roles of activation and inhibition in sex differences in cognitive abilities. Psychological Review, 1969, 76, 325-327.

Smith, I. M. The use of diagnostic tests for assessing the abilities of overseas students attending institutions of further education: Part II. Vocational Aspect of Education, 1971, 23, 39-48.

Sousa-Poza, J. F., Rohrberg, R., & Shulman, E. Field dependence and self-disclosure. Perceptual and Motor Skills, 1973, 36, 735-738.

Spuhler, K. P. Family resemblance for cognitive performance: An assessment of genetic and environmental contributions to variation (Doctoral dissertation, University of Colorado, 1976). Dissertation Abstracts International, 1976, 37, 1963B. (University Microfilms No. 76-23,687)

Stafford, R. E. Sex differences in spatial visualization as evidence of sex-linked inheritance. Perceptual and Motor Skills, 1961, 13, 428.

Stanes, D., & Gordon, A. Relationships between conceptual style test and children's embedded figures test. Journal of Personality, 1973, 41, 185-191.

Szeto, J. W. The effects of search practice and perceptual drawing training upon representational drawing performance and visual functions (Doctoral dissertation, Illinois State University, 1975). Dissertation Abstracts International, 1976, 36, 7135A. (University Microfilms No. 76-9904)

Tendler, R. Maternal correlates of differentiation in hearing children of the deaf (Doctoral dissertation, Yeshiva University, 1975). Dissertation Abstracts International, 1976, 36, 4183B. (University Microfilms No. 76-4563)

Thurstone, L. L. A factorial study of perception. Chicago: University of Chicago Press, 1944.

Trent, E. R. An analysis of sex differences in psychological differentiation (Doctoral dissertation, Ohio State University, 1974). Dissertation Abstracts International, 1974, 35, 2416B. (University Microfilms No. 74-24,414)

Tyler, L. E. The psychology of human differences (3rd ed.). New York: Appleton-Century-Crofts, 1965.

Vernon, P. E. Ability factors and environmental influences. American Psychologist, 1965, 20, 723-733.

Vernon, P. E. The distinctiveness of field independence. Journal of Personality, 1972, 40, 366-391.

Waber, D. P. Sex differences in cognition: A function of maturation rate? Science, 1976, 192, 572-574.

Waber, D. P. Sex differences in mental abilities, hemispheric lateralization and rate of physical growth at adolescence. Developmental Psychology, 1977, 13, 29-38.

Waber, D. P. Biological substrates of field dependence: Implications of the sex difference. Psychological Bulletin, in press.

Wade, E. B. Field-independence, authoritarianism, and verbal reinforcement in anagram solution (Doctoral dissertation, Columbia University, 1971). Dissertation Abstracts International, 1971, 32, 3625B-3626B. (University Microfilms No. 72-1397)

Weiner, M. The effects of differently structured visual fields on the perception of verticality. American Journal of Psychology, 1955, 68, 291-293.

Weitz, J. M. Cultural change and field dependence in two native Canadian linguistic families. Unpublished doctoral dissertation, University of Ottawa, 1971

Weller, L., & Sharan, S. Articulation of the body concept among first-grade Israeli children. Child Development, 1971, 42, 1553-1559.

Werner, H. Comparative psychology of mental development (Rev. ed.). Chicago: Follett, 1948.

Wilkie, D. M. Attention and "visual field dependency" in the pigeon. Journal of Experimental Analysis of Behavior, 1973, 20, 7-15.

Witkin, H. A., & Berry, J. W. Psychological differentiation in cross-cultural perspective. Journal of Cross-Cultural Psychology, 1975, 6, 4-87.

Witkin, H. A., Dyk, R. B., Faterson, H. F., Goodenough, D. R., & Karp, S. A. Psychological differentiation. Potomac, Md.: Erlbaum, 1974. (Originally published, Wiley, 1962)

Witkin, H. A., & Goodenough, D. R. Field dependence and interpersonal behavior. Psychological Bulletin, in press. (Also ETS RB 76-12. Princeton, N.J.: Educational Testing Service, 1976)

Witkin, H. A., Goodenough, D. R., & Karp, S. A. Stability of cognitive style from childhood to young adulthood. Journal of Personality and Social Psychology, 1967, 7, 291-300.

Witkin, H. A., Lewis, H. B., Hertzman, M., Machover, K., Meissner, P. B., & Wapner, S. Personality through perception. Westport, Conn.: Greenwood Press, 1972. (Originally published, Harper, 1954)

Witkin, H. A., Moore, C. A., Goodenough, D. R., & Cox, P. W. Field-dependent and field-independent cognitive styles and their educational implications. Review of Educational Research, 1977, 47, 1-64.

Witkin, H. A., Moore, C. A., Oltman, P. K., Goodenough, D. R., Friedman, F., & Owen, D. A longitudinal study of the role of cognitive styles in academic evolution during the college years. Graduate Record Examinations Board Research Report 76-10R. Princeton, N.J.: Educational Testing Service, 1976.

Witkin, H. A., Moore, C. A., Oltman, P. K., Goodenough, D. R., Friedman, F., Owen, D., & Raskin, E. The role of the field-dependent and field-independent cognitive styles in academic evolution: A longitudinal study. Journal of Educational Psychology, 1977, 69, 197-211.

Witkin, H. A., Oltman, P. K., Chase, J. B., & Friedman, F. Cognitive patterning in the blind. In J. Hellmuth (Ed.), Cognitive studies (Vol. 2): Deficits in cognition. New York: Brunner/Mazel, 1971.

Witkin, H. A., Price-Williams, D., Bertini, M., Christiansen, B., Oltman, P. K., Ramirez, M., & van Meel, J. Social conformity and psychological differentiation. International Journal of Psychology, 1974, 9, 11-29.

Wober, M. Sensotypes. Journal of Social Psychology, 1966, 70, 181-189.

Wober, M. Adapting Witkin's field independence theory to accommodate information from Africa. British Journal of Psychology, 1967, 58, 29-38.

Wohlford, P., & Liberman, D. Effect of father absence on personal time, field independence, and anxiety. Proceedings of the 78th Annual Convention of the American Psychological Association, 1970, 5, 263-264.

Wong, K. L. Psychological differentiation as a determinant of friendship choice (Doctoral dissertation, City University of New York, 1976). Dissertation Abstracts International, 1977, 37, 3639B. (University Microfilms No. 76-30,278)

Yalom, I. D., Green, R., & Fisk, N. Prenatal exposure to female hormones: Effect on psychosexual development in boys. Archives of General Psychiatry, 1973, 28, 554-561.

Yamada, K. T. Extent of psychological differentiation as related to intelligence. Unpublished doctoral dissertation, University of Ottawa, 1968.

Yen, W. M. Sex-linked major-gene influences on human spatial abilities (Doctoral dissertation, University of California, Berkeley, 1973). Dissertation Abstracts International, 1974, 34, 5667B. (University Microfilms No. 74-8856)

Yen, W. M. Sex-linked major-gene influences in selected types of spatial performance. Behavior Genetics, 1975, 5, 281-298.

Zadik, B. [Field dependence-independence among Oriental and Western school children.] Megamot, 1968, 16, 51-58.

Footnotes

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[1]For comprehensive bibliographies see: Witkin, Cox, & Friedman (Note 1); Witkin, Cox, Friedman, Hrishikesan, & Siegel (Note 2); Witkin, Oltman, Cox, Ehrlichman, Hamm, & Ringler (Note 3).

[2]For a recent extended review of the literature on field dependence and interpersonal behavior, see Witkin and Goodenough (in press).

[3]While the patterns of cognitive and social competencies characteristic of field-dependent and field-independent people are the commonly found ones, there is no reason to believe that these patterns are irretrievably set or that they are the only ones possible. Through particular life experiences or special training, some people may acquire the characteristics associated with both modes of functioning, making them mobile in their use of these modes. For a more detailed account of the concept of mobility, see Witkin & Goodenough (Note 4).

[4]There is also evidence from these studies that field dependence-independence may be established in a stable way fairly early in life. For example, RFT test scores for boys at age 10 were substantially correlated with retest scores at ages 14 (r = .71), 17 (r = .72) and 24 (r = .66).

Thus, cognitive styles in the later growth years and in early adulthood may be predicted with some accuracy from knowledge of cognitive styles in the prepubertal period.

[5]The literature on training of spatial-visualization ability (e.g., Brinkmann, 1966; Churchill, Curtis, Coombs, & Harrell, 1942) will not be reviewed in detail here.

[6]Training in simple sensory discrimination (Efland, 1965; Geffen, 1971; McCain, 1970), or general educational programs which may include discrimination training (Miller & Dyer, 1975; Banta, Note 13), do not show consistent effects on measures on field dependence-independence; nor would field-dependence theory lead us to expect such effects.

[7]It was already clear in the very early studies that encouragement of separate functioning was not better or worse than encouragement of continued connectedness with regard to their effects on the child's mental health. When psychological problems developed in children socialized by these two approaches, they appeared to be different, however.

[8]The observation by Seder (1957) and Witkin et al. (1962/1974) that parents of field-dependent children are more likely to socialize against the expression of aggressive behavior than parents of field-independent children may account for the finding in a number of studies that field-independent people are able to express feelings of hostility and aggression directly against others, whereas field-dependent people characteristically avoid expressing hostility in this form (e.g., Bercovici, 1970; Dengerink, O'Leary, & Kasner, 1975; Greenfield, 1969). The use of strict disciplinary procedures by parents of field-dependent

children may also be related to the observed tendency of such children to be particularly responsive to negative reinforcement in learning situations (e.g., Bell & McManis, 1968; Duvall, 1969; Randolph, 1971; Wade, 1971).

[9]The hypothesis relating ecocultural variables to cognitive style was conceived as relevant in subsistence-level peoples only (Berry, 1976); and the evidence available in support of the hypothesis is limited to studies of such peoples alone. A good deal of recent work has been directed, however, at non-subsistence level groups undergoing acculturation. A common finding in these studies is that the experience of education is related to field independence, particularly as manifested in cognitive restructuring skills (e.g., Berry, 1966; MacArthur, 1975; McFie, 1961; Wober, 1966). We have another indication here that particular training experiences may contribute to the development of field independence.